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BRIEFLY TOLD.

THE GLASGOW AND BOARDMAN PAPERS.—With this issue we conclude our official report of the proceedings of the Savannah convention, and the last chapters are as interesting as were the others, and the others were well worth reading and remembering. Mr. Glasgow's paper on "The Practical Efficiency of an Illuminating Water Gas Setting," is of the type which requires more than a hurried or first reading to enable one to appreciate its value; and, more than all, to enable the student to follow out that which it seeks to teach. Its lines teem with evidence, readily enough obtainable at a glance, that Mr. Glasgow labored long and studiously over the task that was assigned him, and he is to be congratulated on the striking way in which the compilation of his studies is set out. One thing that Mr. Glasgow has shown with surprising clearness (and it is not at all in favor of the economy involved in water gas manufacture) is that "the absolute efficiency of the apparatus, considered as a heat machine," is 61 per cent. On the other hand, perhaps this discrepancy (39 per cent.) between the actual result and that theoretically obtainable may point to a greater future for water gas apparatus than it now enjoys; but of this time shall tell the tale. The reader cannot fail to admire the conscientious way in which Mr. Glasgow has conducted his work, and it is quite safe to predict that he will be heard from later on and prominently in connection with his chosen profession.

MR. A. E. BOARDMAN, of Macon, Ga., in his "Hints on Electric Lighting by Small Gas Companies," again gives us evidence of his capacity for conviction, when the verdict is to be based on the testimony of practical working. Something like two years ago Mr. Boardman concluded that he saw his way clear to advocate the policy of operating gas and electric lighting plants in combination, and at a subsequent period did take up the business of dual supply. The proof of the pudding is, of course, in the eating thereof, and having attempted the proof, Mr. Boardman finds that the gas and electric lighting combination is not over sweet, the bitter flavor coming in from the fact that it is not good policy to compete with one's self. And more particularly does this apply in the instance of supplying incandescent electric lighting. Arc lighting undoubtedly is to remain with us for all time, or until it is superseded by a more satisfactory agent for the illumination of *outdoor* areas; but, on the other hand, the gas man has less reason to be exercised over the competition of incandescent electric lighting now than at any other time in its history. It is a light of luxury, that "comes entirely too high" for even 5 per cent. of our population, when properly laid on and maintained—and it will likely be taken for granted that 5 per cent. does not represent the total of those who live in cities and towns that are luxuriously inclined. Mr. Edison's early pronunciamento that the electric light was to be the light of the rich seems to gather force with age, wherefore the Boardman suggestion of "Don't" seems peculiarly appropriate. It is the truly progressive man who, having tried a theory only to find it forceless, admits that his change of practice results from a lack of proof in the theory on which such practice was founded. In this category of progressionists we must place Mr. Boardman, who has throughout his business lifetime never thought it worth while to cut off a finger because the nail thereof needed paring.

AS was intimated some weeks ago in the JOURNAL, the real cause of the imperfect gas supply in the northwestern section of Philadelphia was inadequate main or service piping, and not a poor quality of illuminating vapor. Director Wagner has received scores of letters charging the inequality to the first named cause, but since the main conditions have been somewhat improved the tone of the missives received by him has assumed another key. Here, for instance, is a copy of one that was forwarded him by N. C. Clelland, Receiver of the Ridge Avenue Passenger Railway Company: "The new, large service pipe recently laid has done wonders, and all night long we have a plentiful flow of gas. I may here say that never since this depot was built have we had any such flow of gas of such illuminating power, which shows conclusively that the trouble was not in the gas, but in the size of the pipes."

IT should not be forgotten by those interested that a special meeting of the stockholders in the Municipal Gas Light Company, Rochester, N. Y., will be held in this city, at the office of the Warren Foundry and Machine Company, 160 Broadway, on the afternoon of Dec. 23. It is called for the purpose of concluding an arrangement, entered into by the Directors of the Rochester and Municipal Gas Light Companies, for the amalgamation of the two Companies. The transfer books close today, to be re-opened on the 24th inst.

IT looks as if the Peoples Co-operative Electric Lighting Company, of New Bedford, Mass., really means to construct and operate a plant in that city. We imagine, however, that it will be hard to convince the State Board that another Company is necessary to the welfare of the old Whaling City.

MR. BROWN S. FLANDERS, Superintendent of the fire alarm system of Boston, has been appointed by Mayor Hart to be Inspector of Wires for the year ending April 30, 1891, and until his successor is appointed and confirmed. This is the first Superintendent that has been appointed under the ordinance creating the office.

[Concluded from page 774.]

[Official Report—Revised by the Secretary.]

EIGHTEENTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

Held at Savannah, Ga., October 15, 16 and 17, 1890.

Second Day—Afternoon Session.

The Association met at 2 P.M. On motion of Mr. Fodell, seconded by Mr. Harbison, the following resolution was adopted:

That the Committee of Arrangements for the New York meeting be authorized to provide a banquet at that meeting, and to make all proper arrangements therefor; it being understood that the expense be assessed pro rata upon each member attending. The resolution was adopted.

Mr. A. G. Glasgow, of Philadelphia, Pa., read the following paper on

THE PRACTICAL EFFICIENCY OF AN ILLUMINATING WATER GAS SETTING.

As a prefatory note, let me state that this paper treats exclusively of water gas apparatus of the Lowe type, *i. e.*, where the energy of the generator blast products is utilized in gasifying the enriching oil through the medium of a "superheater."

I will also state that the results given herein all refer to 1,000 cubic feet of unpurified carbureted gas, and that the gases are reduced to 60° F.

The secret of fuel economy in the manufacture of water gas lies in the following apothegms:

Keep the generator fire in a uniformly hot and healthy condition, varying as little as possible from the best temperature for gas production. This necessitates short runs and blows, their relative lengths being determined experimentally. Never admit an excess of steam. Always admit a sufficiency of steam. So adjust the blasts that the generator and superheater shall reach their proper respective heats simultaneously, while all the oxide produced is being consumed in superheater with no excess of air. Keep the superheater bricks clean.

These conditions being fulfilled, as closely as practice permits, have we then reached for all time the highest attainable efficiency? If not, where shall we look for further improvement? The desire to answer this last question, with accuracy, has led to several weeks of experimental work, some of the results of which are incorporated in the paper about to tax your patience.

The chief aim of these investigations has been to establish an equation, or heat balance, in which there shall be no unknown quantity, the one side representing the fuel consumed in the apparatus, and the other the itemized energy obtained or dissipated therefrom. To this end, the first step was to weigh the total fuel (anthracite coal) fed into the generator, and the ash and unconsumed coal recovered—the difference being the total combustible used. This combustible may, without appreciable error, be considered pure carbon, with a heating equivalent of 14,500 British thermal units per pound. A carefully selected average of results gives, per M. of uncarbureted gas:

Table I.

Total anthracite charged	33.4 lbs.
Ash and unconsumed coal recovered	9.9 "
Total carbon consumed	23.5 "

The average composition, weight and specific heat of the unpurified carbureted gas, the uncarbureted water gas, the blast products escaping from superheater and the generator blast gases are recorded below in the order named:

Table II.—*Carbureted Gas.*

	Composition by Volume.	Weight per 100 Cu. Ft.	Composition by Weight.	Specific Heat.
$CO_2 + H_2S$	3.8	.465842	.09647	.02088
C_nH_{2n}	14.6	1.139968	.23607	.08720
CO	28.0	2.1868	.45285	.11226
CH_4	17.0	.75854	.15710	.09314
H	35.6	.1991464	.04124	.14041
N	1.0	.078596	.01627	.00397
	100.0	4.8288924	1.00000	.45786

Table III.—*Uncarbureted Gas.*

	Composition by Volume.	Weight per 100 Cu. Ft.	Composition by Weight.	Specific Heat.
CO_2	3.5	.429065	.1019	.02205
CO	43.4	3.389540	.8051	.19958
H	51.8	.289821	.0688	.23424
N	1.3	.102175	.0242	.00591
	100.0	4.210601	1.0000	.46178

Table IV.—*Blast Products Escaping from Superheater.*

	Composition by Volume.	Weight per 100 Cu. Ft.	Composition by Weight.	Specific Heat.
CO_2	17.4	2.1330660	.2464	.05342
O	3.2	.2856096	.0329	.00718
N	79.4	6.2404224	.7207	.17585
	100.0	8.6591980	1.0000	.23645

Table V.—*Generator Blast Gases.*

	Composition by Volume.	Weight per 100 Cu Ft.	Composition by Weight.	Specific Heat.
CO_2	9.7	1.189113	.1436	.031075
CO	17.8	1.390180	.1680	.041647
N	72.5	5.698210	.6884	.167970
	100.0	8.277513	1.0000	.240692

Table I. gives $23.5 \times 14{,}500 = 340{,}750$ heat units for the energy absorbed by the apparatus. This quantity forms the debit side of our heat balance, and will be designated for the present by the letter A. Its disposition is as follows:

B = energy of the CO produced.
C = energy absorbed in the decomposition of the steam.
D = difference between the sensible heat of the escaping illuminating gases and that of the entering oil.
E = heat carried off by the escaping blast products.
F = heat lost by radiation from the shells.
G = heat carried away from the shells by "convection" (air currents).
H = heat *rendered latent* in the gasification of the oil.
I = sensible heat in the ash and unconsumed coal recovered from generator.

Our equation, therefore, reads: $A = B + C + D + E + F + G + H + I$; A being known.

To find B: It is first necessary to determine the volume of pure water gas per M. (M. being always understood to mean 1,000 cubic feet of unpurified carbureted gas). Taking CO as an index, a comparison of Tables II. and III. shows that $\frac{28.5}{43.4}$, or 64.5* per cent., of the volume of the carbureted gas is pure water gas, distributed as shown in Table VI.

Table VI.

CO_2	2.3	64.5 per cent.
CO	28.5	
H	33.4	
N	.8	

One pound of CO at 60° F. contains 13.531 cu. ft. The CO, per M., therefore weighs $280 \div 13.531 = 20.694$ lbs. Hence the energy of the CO is: $B = 20.694 \times 4{,}395.6 = 91{,}043$ heat units.

To determine C, the energy absorbed in the composition of the steam, table VI., shows that 334 cu. ft. of H are liberated in the generator, per M. of carbureted gas made. A pound of H at 60° F. contains 189.2 cu. ft. Hence $334 \div 189.2 = 1765.3$ lbs. H. According to Thompson, the combustion of a pound of H develops 61,524 units of heat. In the experiments under consideration the steam entered the generator at a temperature of 331° F. We have, therefore, to deduct from Thompson's figure the total heat required to raise the product of combustion of one pound of H from 75° to 331° F., 75° being about the temperature to which his products were reduced. This gives $1{,}140.2 \times 8.98 = 10{,}239$ heat units. Therefore $61{,}524 - 10{,}239 = 51{,}285$ heat units is the energy absorbed in the generator per pound of H liberated, and $C = 51{,}285 \times 1.7653 = 90{,}533$ heat units.

It now becomes necessary to know the temperatures at which the illuminating gas and blast products leave the superheater, as well as the volume of the blast products. A very brief description of how these determinations were made will suffice.

The temperatures were determined by means of copper balls and a calorimeter, every precaution essential to accurate scientific work being observed. In addition, a pyrometer was used to note the variations in temperature of the illuminating gas, its readings being checked by means of the copper balls. Special care was taken that the balls should reach the full temperature of the gas before being removed, that no heat should be lost during the transmission from the apparatus to the calorimeter, and that no ebullition should take place when the heated ball was plunged into the water. These latter points were successfully guarded against by enclosing the ball in a small copper cup immediately upon withdrawing it from the superheater, the cup being completely enveloped in a pair of wooden tongs. From the time the ball was withdrawn from the superheater until it was submerged in water averaged about nine seconds. The average temperatures were:

* Several runs of uncarbureted gas made directly into the relief holder, measured 66 per cent of the average carbureted make.

TABLE VII.

Illuminating gas	1,450° F.
Blast products	1,550° F.
The temperature of the oil entering carburetor was	235° F.
The temperature of the entering blast was	76° F.

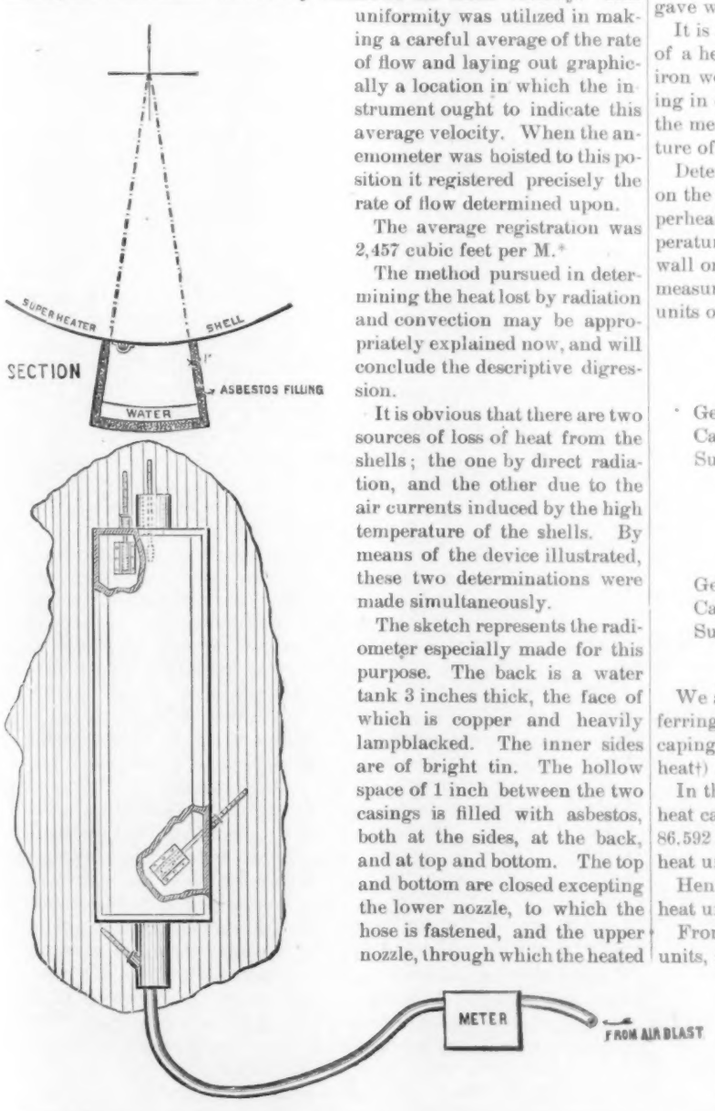
The blast was measured by an anemometer provided (by the maker) with a special table of corrections. To keep the anemometer from overrunning its limit of speed a short section of 32″ pipe was placed in the main line of 16″ blast pipe, and in this the instrument was located on a movable bearing, a glass window enabling it to be read while in place. In spite of carefully designed baffling plates in either end of the 32″ section, the rate of flow was found to vary largely with the position of the anemometer. In a given position, however, and under the same conditions, the instrument invariably indicated the same velocity. This uniformity was utilized in making a careful average of the rate of flow and laying out graphically a location in which the instrument ought to indicate this average velocity. When the anemometer was hoisted to this position it registered precisely the rate of flow determined upon.

The average registration was 2,457 cubic feet per M.*

The method pursued in determining the heat lost by radiation and convection may be appropriately explained now, and will conclude the descriptive digression.

It is obvious that there are two sources of loss of heat from the shells; the one by direct radiation, and the other due to the air currents induced by the high temperature of the shells. By means of the device illustrated, these two determinations were made simultaneously.

The sketch represents the radiometer especially made for this purpose. The back is a water tank 3 inches thick, the face of which is copper and heavily lampblacked. The inner sides are of bright tin. The hollow space of 1 inch between the two casings is filled with asbestos, both at the sides, at the back, and at top and bottom. The top and bottom are closed excepting the lower nozzle, to which the hose is fastened, and the upper nozzle, through which the heated air issues. A thermometer is located in each of these nozzles. When in contact with the shell of the apparatus the radiometer embraces a strip 1 foot wide and 4 feet high, making 4 square feet of radiating surface. It is evident that when the radiometer is brought into air-tight contact with the shell of the apparatus the temperature of the inclosed portion of the shell will begin to rise, due to the jacketing action of the instrument. This effect was prevented by passing such a current of air through the radiometer that the inclosed shell was kept at its ordinary working temperature. In other words, we produced artificially the precise conditions of convection and radiation that prevail in practical working, and by metering the air used and observing the initial and final temperatures, the loss due to convection was accurately measured, while the observed rise in the temperature of the known weight of water contained in the calorimeter, plus the aqueous equivalent of the latter, gave with equal exactness the loss due to radiation.



It is a nice problem to determine correctly the temperature of the skin of a heated shell. For this purpose small and very light cups of cast iron were screwed to the shell and filled with mercury, the mercury being in contact with the surface of the shell. A thermometer dipped in the mercury would indicate, within practical limits, the exact temperature of the skin of the shell.

Determinations were made with the radiometer at 16 different points on the shells—4 on the generator, 4 on the carburetor, and 8 on the superheater—2 or more tests being made at each point. The average temperature of the water in the radiometer was adjusted to equal that of the wall or surrounding apparatus towards which the portion of the shell measured was radiating. Below is an average of the results obtained in units of heat:

TABLE VIII.—*Loss of Heat by Radiation from Shells.*

	Loss per Sq. Ft. of Radiating Surface per 24 Hours.	Total *Revised Radiating Surface in Sq. Ft.	Total Loss per 24 Hours.	Loss per M. (426.2 M. per 24 Hours).
Generator	5,930	208	1,233,440	2,894
Carburetor	4,851	293	1,421,343	3,335
Superheater	5,470	485	2,652,950	6,225
			5,307,733	12,454

TABLE IX.—*Heat Lost by Convection.*

	Loss per Sq. Ft. of Surface per 24 Hrs.	Total Surface in Sq. Ft.	Total Loss per 24 Hours.	Loss per M. (426.2 M. per 24 Hours).
Generator	7,216	188.5	1,360,216	3,191
Carburetor	6,334	346.5	2,194,731	5,149
Superheater	6,000	522.5	3,135,000	7,356
			7,689,947	15,696

We are now prepared to determine the remaining items of heat. Referring to tables II. and VII., we find that the heat lost, due to the escaping illuminating gases, is: D = 48.29 (weight) × .45786 (specific heat†) × 1,215° (rise in temp.) = 26,864 heat units.

In the same way, referring to tables IV. and VII., we have for the heat carried off in a thousand cubic feet of the escaping blast products: 86.592 (weight) × 23,645 (specific heat) × 1,474° (rise in temp.) = 30,180 heat units.

Hence the total heat so carried off is: E = 30,180 × 2.457 = 74,152 heat units.

From table VIII. we see that the loss by radiation is: F = 12,454 heat units, and table IX. gives us for convection: G = 15,696 heat units.

To determine H, the heat *rendered latent* in the gasification of the oil: This can be found by taking the difference between all the heat fed into the carburetor and superheater and the total heat dissipated therefrom. It is evident that the excess of the former over the latter will represent the heat rendered latent in the gasification of the oil. It is first necessary to find the energy contained in the generator blast gases per M. of carbureted gas. Reference to table IV. shows that all the CO in the generator blast gas is consumed in the carburetor and superheater, with an excess of air equal to 15.2 per cent. of the total volume of air used; the volume of the resulting products being equal to this total volume of air, 2,457 cubic feet.

The generator blast gas contains (see table V.) 17.8 per cent. CO.

17.8 parts CO + 42.4 parts air, yield on combustion, 17.8 parts CO_2 + 33.5 parts N, increasing the volume of generator blast gas to 133.5 parts.

Adding the excess of air, we have 1.335 ÷ .848 = 1.575 for the relative volume of the final blast products.

Hence, 2,457 ÷ 1.575 = 1,560 cubic feet is the volume of the generator blast gases per M.

* Table IV. shows an excess of air of 15.2 per cent. of the total air passed through apparatus. It will be interesting to see how this compares with the anemometer registration of 2,457 cubic feet of air per M. of carbureted gas.

The quantity of carbon consumed by this air is the total combustible, 23.5 pounds, less the carbon that combined with the oxygen of the steam to form (Table VI.) 23 parts CO_2 and 280 parts CO.

23 ÷ 8.623 = 2.667 lbs. CO_2, and
280 ÷ 13.531 = 20.694 lbs. CO.
C in CO_2 = 2.667 × $\frac{3}{11}$ = .73 lbs.
C in CO = 20.694 × $\frac{3}{7}$ = 8.87 lbs.

Total C combined with O of steam = 9.60 lbs.
23.5 — 9.6 = 13.9 = total lbs. of carbon consumed per M. during blast.
13.9 × $\frac{8}{3}$ = 37.1 gives the pounds of O required for its combustion.
37.1 × 11.84 ÷ 20.8 = 2,112 gives the cubic feet of air required for perfect combustion. 2,457 — 2,112 = 355 cubic feet excess; 345 ÷ 2,457 = 14 per cent. of total air used.

* The "neutral" portion, or that part of the shell that radiates to the adjoining shell or shells has been stricken out, as well as the portion of generator below the grate line.

† The specific heat of the entering oil is approximately that of the issuing gas.

1,560 × .178 = 277.68 cubic feet CO per M.

277.68 ÷ 13.531 = 20.5 pounds CO per M.

20.5 × 4,395.6 = 90,110 units of heat generated per M. by the combustion of the generator blast gases.

To obtain the total energy fed into carburetor and superheater, the sensible heat in the above gas must be added to this figure. This we found from table V. to be 82.775 × .2407 × 1.560 × 1,474°* = 45,812, making the total energy sought 90,110 + 45,812 = 135,922 units of heat.

This energy is disposed as follows:

D, difference between the sensible heat in the escaping illuminating gases and the entering oil;

E, heat carried off by the escaping blast products;

F′, heat lost by radiation from the *carburetor* and *superheater;*

G′, heat carried away from the *carburetor* and *superheater* by convection;

H, heat *rendered latent* in the gasification of the oil. Hence,

H = 134,577 — (D+E+F′+G′)
= 135,922 — (26,864+74,152+9,560+12,505)
= 12,841† units of heat. The sensible heat in the ash and unconsumed coal is—

I = 9.9 × 1,500° × 25 (sp. ht.) = 3,712 heat units.

This completes the heat determinations, of which the following table is a resume:

RESUME.—*Distribution of Energy per M.*

Anthracite coal fed into generator	33.400	—
Ash and unconsumed coal recovered	9.900	—
A. Total combustible (carbon)	23.500	340,750
B. Energy of the CO produced	6.280	91,043
C. Energy absorbed in the decomposition of the steam	6.243	90,533
D. Difference between the sensible heat of the escaping illuminating gases and the entering oil	1.852	26,864
E. Heat carried off by the escaping blast products	5.115	74,152
F. Heat lost by radiation from the shells	.858	12,454
G. Heat carried away from the shells by "convection" air currents	1.082	15,696
H. Heat *rendered latent* in the gasification of the oil.	.886	11,496
I. Sensible heat in the ash and unconsumed coal recovered	.256	3,712
Total energy accounted for	22.572	327,295
Unaccounted for (4 per cent.)	.920	13,455
Air used per M., in cubic feet	2,457	
Candle power	31	
Gallons of oil per M	5	
Candles per gallon	6.2	
Specific gravity (calculated)	.6355	

The energy accounted for may be divided into:

Energy utilized	13.409 lbs.
Energy wasted	9.163 "

Considering the total unaccounted-for energy as utilized, there is a waste of $\frac{9163}{23500}$, or 39 per cent. of total combustible, and the absolute efficiency of the apparatus, considered as a heat machine, is $\frac{14337}{23500}$, or 61 per cent.

The *commercial* efficiency, or the efficiency of the apparatus regarded as a producer of a finished product, is influenced by an additional function, namely, the percentage of the total oil consumed that is utilized by the conversion into gas. In the above experiments 5 gallons, or 35 lbs. of crude petroleum were fed into the carburetor per 1,000 cubic feet of gas made. Deducting 5 pounds for tar recovered leaves 30 lbs. of petroleum, or 30 × 20,000 = 600,000 units of heat to be accounted for per M. The heating power per M. of the carbureted gas is:

CO_2	38.0	
C_2H_4‡	146.0 × .117220 × 21222.0 =	363,200
CO	280.0 × .078100 × 4395.6 =	96,120
CH_4	170.0 × .044620 × 24021.0 =	182,210
H	356.0 × .005594 × 61524.0 =	122,520
N	10.0	
	1,000.0	764,050

The heating power of 1,000 feet of uncarbureted gas is:

CO_2	35.0	
CO	434.0 × .078100 × 4395.6 =	148,991
H	518.0 × .005594 × 61524.0 =	178,277
N	13.0	
	1,000.0	327,268

Since 64.5 per cent. by volume of the carbureted gas is pure water gas, 764,050 — 327,268 × 0.645 = 553,000 heat units represents the energy of the oil converted into gas; the unaccounted for difference of 47,000 heat units being 8 per cent. of the total. This discrepancy I shall not at present attempt to explain, beyond stating that it is probably due to overestimating the heating value of the oil, and not recovering all the vapors condensed to tar and oil.

The commercial efficiency of the apparatus—*i. e.*, the ratio of the energy contained in the finished product to the total energy (coal and oil) introduced—is, therefore, 81 per cent.

The writer apologizes for the crude shape in which the above results have been submitted to you, and realizes that he has scarcely opened a very broad subject. He hopes, however, to be able in the near future to follow it out to a profitable conclusion.

Discussion.

The President—Gentlemen, you have heard another very interesting and valuable paper, and if I could not have procured a copy of this paper in any other way I would have been perfectly willing to pay the entire cost of coming to this meeting to have the data which he has furnished us. I shall not take up your time. Mr. Glasgow is prepared to answer any question that anyone is inclined to ask.

Mr. Forstall—This is a paper that ought to be studied over for three or four months before we can really understand it. A very good plan would be to see what is the total theoretical quantity of carbon actually necessary to produce 1,000 cubic feet of gas, without taking into account any losses by convection and radiation, or the heat of the escaping gases. That would show us what we might hope to save by improved design in the apparatus. Beyond that, of course, we could not go. To do that I have figured on the analysis of water gas I already have to see how much of the total carbon is represented in the water gas, and how much is actually necessary to raise sufficient heat to decompose the amount of hydrogen that was present in the gas. I did that in two ways. I first took it, taking the conditions that actually existed in the machine, where, owing to the depth of fuel necessary to produce good water gas, we are not able to burn the carbon used up entirely to carbonic acid, but must convert a large part into carbonic oxide. Then I also did it by taking the carbon as entirely converted into carbonic acid, getting up the heat for gasifying oil in some other way. I had no data for the first case, and had to wait until Mr. Glasgow's paper gave them to me. My results were that for my analysis we had in the water gas 9.11 pounds of carbon. If we converted the carbon, in the proportions usually present, into carbonic oxide and carbonic acid, we would need 11.2 pounds to decompose the steam, which would give us 20.31 pounds of carbon to be used in the generator. So that in that regard the only gain left to us would be 3 pounds of the total amount of carbon used in the generator. Assuming that we convert the carbon into carbonic acid, we would have 9.11 pounds in water gas, we would need 4 pounds to raise the heat necessary to decompose the hydrogen, and we would need 0.793 pounds to gasify the oil, or a total of 13.9 pounds. So that if we could save all the heat lost to the illuminating gas by convection and radiation, we would have a saving of about 9 pounds. I think that is all we can possibly get.

Mr. Norris—The assumption that the specific heat of oil gas is practically the same as that of the oil, I think introduces a slight error. Take the case of water. The specific heat in the form of liquid is 1 while in the form of gas, if I recollect rightly, it is about .48. The point that I want to bring up, however, is that of the analyses. The analyses of blast gases have bothered me a great deal. I cannot make them check; whereas these check very well. All the oxygen appearing in these blast gases must come from the air which is introduced. The nitrogen in the analyses gives us a way of finding out how much oxygen has been supplied. That is the debit side of the calculation. The credit side would be the oxygen in the carbonic oxide and in the carbonic acid. As I said these analyses figure up pretty closely; but we are constantly seeing analyses of producer or blast gases which do not so check up. I would like to get some information from Mr. Glasgow, and from members, as to what their experience has been in this direction. I see, in "McGregor, on the Gas Engine" an analysis of blast gas which gives a discrepancy in the proportion of 12 parts of oxygen supplied to 5 parts accounted for.

* This temperature was not determined, but is assumed to be the same as that of the blast products escaping from superheater.

† This includes also the heat carried off in the vapors that condense to tar.

‡ The heating value of the illuminants $C_n H_{2n}$ is assumed to equal that of C_2H_4. In the former determinations of density and specific heat C_2H_4 were taken. As no determinations were made of the individual hydrocarbons present, that is, in both cases, purely an assumption.

In other words there seems to be a disappearance of the oxygen. The question is, what becomes of that oxygen. In working up a paper of this sort correct analyses are very important, and the way to get these analyses is what bothers me. I would like to ask whether any one who has had occasion to make these analyses has figured them up in this way to see if they will check; and if they do check, what system of analysis they used. The one that I have used has been the Hempel, and there is always too much oxygen, or too little nitrogen, whichever way we look at it. Mr. Glasgow has either been more fortunate or more skillful.

Mr. Somerville—I agree with you that Mr. Glasgow deserves the very highest credit for this paper. I would like to ask Mr. Glasgow if I understood him to say that the heat of the machine in practice gave 61 per cent. of theoretical efficiency; or that 61 per cent. was the practical result arrived at.

Mr. Glasgow—If the President will permit me I will try to answer these questions before I forget them. I said that 61 per cent. was the practical efficiency of the apparatus considered as a heating machine, and not as a manufacturer of a salable product. What I mean by that is that 61 per cent. of the total combustible consumed in the generator was utilized. Mr. Forstall points it out correctly when he says that we can save 9 pounds of fuel. The energy accounted for may be divided into the energy utilized, 15.215 pounds, and energy wasted 9.163 pounds. In reply to Mr. Norris' last statement I will say that I can entirely sympathize with him in his suggestion of the disappearance of the oxygen. I have had trouble in that way myself. These analyses are not the actual average of all the analyses I made, but they are the selected average. That is, I have presented here what I believe to be the facts; and when I made the analyses, if any were manifestly incorrect, I excluded them. I believe the trouble is not so much in the awkwardness of manipulation as it is in the absorption of carbonic acid when you collect and treat your analysis with water. Mr. Norris asked me a question in the beginning that I do not recall at the moment.

Mr. Norris—The assumption as to specific heat.

Mr. Glasgow—This was not actually an assumption of mine; the assumption was merely that of difference in material. The specific heat of the gas I have determined here to be .45786; the specific heat of petroleum from the best authorities I can get (and which I do not vouch for) is .434. That is a very small difference; and so I have excluded it as not worth treating. Mr. Forstall certainly arrives at just the same conclusions I have here; that is, that there is a possibility of saving 9 pounds by saving all losses. In other words, the ultimate goal that we may strive for, but never hope to attain, is a consumption of 13.215 pounds of carbon per 1,000 cubic feet of gas. In reply to Mr. Somerville's question, I would further say that what I have reported, 61 per cent. as the efficiency of the machine, must be understood as relating to the combustible consumed, and not to the coal shoveled in. I used 33.4 pounds of coal per 1,000, and only consumed 23.5. Every one will see that there is a real chance for economy: that is, to get some kind of machine that will burn all the coal to ash. Of course you can recover some of this cinder by screening; but there the incident of labor comes in, which makes it questionable whether it is worth while or not.

Mr. Forstall—With reference to the unconsumed coal, I think it does pay to screen it. A man can screen out per day enough to make his wages, and make the coal that you recover cost only one-third that of the original coal that you put in, and I have never been able to find but that that coal was just as good after it has been screened as it was when first put into the machine.

Mr. Rusby—I am very much pleased to see this paper come out. I feel confident that not only does it contain information which has never before been put in this condensed form, but a great deal of it has been matter of conjecture altogether. As this experimental work has given us figures on which we can rely in our own works it is of very great value to us. The thing which will interest most of us specially is the outcome, and the amounts of heat lost in various ways. I call attention to the fact that the loss in the blast gases coming out of the stack is greater than all other sources of loss combined. As Mr. Forstall and Mr. Glasgow have mentioned, there is only a possible saving of some 9 pounds of coal; but it leads us up to one subject, and that is the heating of our blast, which ought to be done with the heat of the waste gases. And although we may not save a very large per cent. of the heat that these contain, yet I think that there is also an incidental saving, which will be considerable, in the increased capacity of the set, and possibly an incidental economy in enabling us to use our fuel better. Between 20 and 25 per cent. of the total heat goes out with the blast gases, and if we can recover one-half of that it is quite an item. Besides, there are the incidental economies, which it seems reasonable would be considerable, in increasing the capacity of the set, and in utilizing the fuel that is put in.

Mr. Chollar—It seems to me that this Association, nor any Association, has ever before had presented to it such a mass of statistics in so small a compass; and I feel that it is utterly impossible in any discussion which can be brought out here extemporaneously to begin to do justice to the subject, or to the writer. The paper will be as valuable—and more so—ten years from now as it is to-day. I move that a real and earnest vote of thanks be given to the writer.

Mr. Boardman—I second the motion of Mr. Chollar, and I do so with very great pleasure. I have looked around upon the members here present, and I have felt with them and for them. I am glad to see that the younger members of this Association are taking an interest and a stand which is theirs by right of education, and by right of the experience that has been bequeathed to them, and which they are carrying on to higher results than any others of us have attained. I mean in the scientific analyses of our business. I have looked around upon this assemblage during the reading of this paper, and since the discussion began, and I have noticed that none of the old stagers have had much to say. The discussion has been carried on by the younger men; and I am glad to see it. Even the President did not stop a very earnest discussion of this paper between the members for fear they were getting ahead of him in the discussion of the paper; and Mr. Chollar gave it up—for I saw him put up his glasses, as much as to say, "I have got to study this thing more." Gentlemen, this is a hopeful sign. In seconding the motion of Mr. Chollar I feel humiliated that in the busy conflicts of this world in amassing wealth, in striving to attain the almighty dollar, I, and many of the older members of the Association, have not kept up with the progress of the times. I welcome this paper, and I wish to encourage every member who will give such a paper to the Association, as the earnest of a brighter day for our Association, when the ultimate analyses of our profession shall be as trite in our discussions here as is the subject of naphthaline. (Applause.)

Mr. Harper—I do not wish to take any further part in the discussion of this paper than to say that I had occasion to see most of this work of Mr. Glasgow as it was carried on from day to day; and I wish simply to say that I can vouch for the conscientious way in which the whole of this work has been done. I think so far as the figures can be made reliable Mr. Glasgow has made them so.

The President—Before putting the question I would like to ask Mr. Glasgow whether the piece of 30-inch pipe which was introduced into the 15-inch for the purpose of starting up the current was of a conical shape, or whether there was not an abrupt enlargement.

Mr. Harbison—Before that question is answered may I ask whether I understood the President correctly as stating that a 30-inch pipe was inserted into a 15-inch? (Laughter.) That is the way I understood his question.

The President—That question is from one of the *older* members. (Laughter.)

Mr. Glasgow—In reply to the President's question, I will say that this 32-inch pipe was about 6½ feet long from end to end; it was cylindrical for about 4 feet of its central portion and shaped off conically at the end. About 6 inches from each side, where the cone cut the cylinder, a diaphragm was put in, which was simply drilled with 2-inch holes distributed so that the aggregate would be equal to a cross-section of 18-inch pipe, and distributed so as to throw the blast out towards the side. I was amazed to find that after having such a plate, both fore and aft, the blast was not distributed. It was extremely local. It was three times as fast in some places as in others. In determining this average we laid out a life-size plan, and noted the speed as determined by this anemometer in different places of the section, and this we did every day, always preserving the difference as close as possible to the limit of the previous day's work. We averaged it all up, and divided up the section, giving each portion its speed, and determined upon a place where it ought to indicate average speed. On putting the anemometer into this place we found that it indicated precisely that speed. In reply to Mr. Forstall's remarks about the ash, I do not want to go on record as not encouraging the screening of cinders from hard coal; but I have found that in the use of the Kansas coke the game was not worth the candle. However, this coke burns up cleaner than coal. We ran on 30½ of coke, where we had been using 34½ of anthracite coal—the amount of combustible being the same—so that the difference is in the screenage. I thank you, Mr. President and gentlemen, for your very courteous reception of this paper.

The President—I asked the question because I had had considerable experience in the use of the anemometer in connection with natural gas; and in my earlier experience I noticed that unless the pipe was enlarged conically so as to take up about the position that the gas would take in expanding on coming out of the pipe, it was very difficult to get

anything like accurate measurements through an anemometer. By having the cylinder conical we got very accurate results. You have heard the motion to return a hearty and earnest vote of thanks to Mr. Glasgow for his paper. [Adopted.]

AN EXPLANATION IN RESPECT TO THE COMMITTEE ON WORLD'S FAIR.

Mr. Harbison—Mr. Boardman, who is to read the next paper, has kindly consented that, with your permission, I might occupy what is known in Indian parlance as "two breaths," or, in United States language, as "two minutes." If you will permit me I will endeavor not to be longer than that. The honored President of this Association, brother McMillin, having become during the year a gentlemen of leisure, went to Europe, and during his absence it devolved upon me, as First Vice-President to call together the World's Fair Committee, and to have somewhat an active part in the formation of that Committee, by consultation and advice with those who are interested in the matter. The President in his Address referred to the fact that the industries connected with our profession have been apparently overlooked in the selection of the personnel of the World's Fair Committee, as appointed by the various Associations, and that he thought it was an oversight and a mistake. Your Committee on the President's Address has recommended, and you have adopted the recommendations, that the Council take note of that, thinking it was an oversight on their part. I desire to say, if you will permit me, that it was designedly so, and only after careful consultation with various gentlemen engaged in the industries connected with our profession; and for this reason: It was impossible to put on a Committee that would be efficient, a representative of every manufacturing concern in the country of gas stoves, gas engines, gas works supplies, and everything of that kind—all of whom we hope will come forward and make an elegant display. We thought if we made a selection from amongst the number jealousies would at once crop out. And so, in consultation with representative men in the various industries, after making the suggestion to them, they said, "You are right. Put no one on the World's Fair Committee that is engaged in the manufacture of any supply for the gas profession. Then all will be treated alike, and your exhibition will be a success." In naming the personnel of the various committees representing the various Associations, one further matter was kept carefully in view, namely, that we wanted to keep down the expense attending the work of this Committee to the lowest possible dime. Hence you will find, if you look over the personnel of the various members of that Committee, that some are named by some 2 or 3 different Associations, so that you need not have too large a number in numerical strength. They did not propose that this Committee should be a junketing affair, to travel over the United States for their own pleasure, at the expense of the Associations, but that they should do the work without compensation, the Associations paying only what was absolutely necessary for actual expenses. The Committee do not propose (and I know that I voice the sentiment of every member that has been named) to have the Committee as a Committee, with all the members present, to attend to the detailed work, but to appoint executives, or sub-committees to whom shall be delegated the various duties to be performed, so as to keep the work of that committee down to the lowest possible item of expense. I think further, that I may say, from what the President has intimated to me, that if he had understood the facts in the case he would not have stated in his Address just what he did. I think that he wrote his Address without knowing what actuated the Associations in the appointment of their committees—he being, as I say, not necessarily, but for pleasure, absent from the country, and enjoying, which I am happy to see he does at times, a portion of the income of his large wealth—and a very sensible thing it is for any gas man to do. It appears to me, Mr. President and gentlemen, that your Committee (with perhaps the one single exception on it) is the best selection you could have made; and I think it would be a mistake to have any change made in the present arrangement of that Committee. Your Committee is large enough. The duties will be confined principally, I apprehend, first of all, to getting sufficient space from the World's Fair Committee in Chicago for a gas exhibit, and seeing that the gas industries are well located in the building; and then to interest manufacturers in bringing their exhibits to the fair. I apprehend that those will be the duties of your Committee, and those only. I say this much by way of explanation, and in behalf of the Council to whom you have referred portions of the President's Address, so that if they did not take any action you will understand the reason why. If you have any orders to give in connection with the matter I have no doubt your Committee will strictly obey them.

The President—The statement of Mr. Harbison is absolutely correct. I did not know the reason for the appointment of the committee that was appointed until after my Address was written and until after I was here. While I believe the suggestions were right, and although I would not have made them if I had been in possession of the facts, yet having made them, and believing them to be right, I did not care to strike them out; and so they were left in there for the committee on the President's Address to struggle with. They took the same view of it, then submitted it to the Association, and the Association apparently took the same view of it; but they have very properly left the matter with Mr. Harbison, the President and the Council to do with it as they may think proper in the coming year.

TWO TELEGRAMS.

The Secretary read the following telegrams:

"TORONTO, October 16th, 1890.

"C. J. R. Humphreys, Secretary. Please convey my sincere thanks to the Association for the honor done me in electing me Vice-President. Much regret my inability to attend the meeting. W. H. PEARSON."

"To the President of the American Gas Light Association.

"SAVANNAH, GA.

"Dear Sir:—I am instructed by the Board of Directors to extend to the officers and members of your Association, and the ladies accompanying them, the privileges of the Savannah Cotton Exchange during their stay in the city. Very respectfully, J. B. MERIDAN, Supt."

On motion of Mr. Harbison the invitation was accepted with the thanks of the Association.

THE PRESIDENT ANNOUNCES THAT HE HAS MADE A DISCOVERY.

The President—Perhaps you have not known about it, but there is a wonderfully fine exhibit of gas burners, gas stoves, and gas appliances of all kinds in the basement at the corner of this building. By accident I found it myself; and I think that the gentleman who arranged the exhibit ought to be reprimanded for not having made it known before this time.

Mr. A. E. Boardman, of Macon, Ga., read his paper entitled

HINTS ON ELECTRIC LIGHTING BY SMALL GAS COMPANIES.

"Once upon a time" the *London Punch* was asked advice by a young man about to be married. With that admixture of wisdom and drollery which characterized him, he summed up a world of warning, which he was perfectly well aware would not be heeded, in the single word, "*Don't.*"

So, with equal seriousness, and with equal certainty that my advice will not be taken, I give my first *hint* to small gas companies about to engage in electric lighting. It is contained in the single word, "*Don't.*"

This doubtless seems a radical departure from the position which I have hitherto maintained in the discussions on this subject before this Association, and demands a word of explanation. It is not so much a new departure as a change of front made necessary by fuller knowledge. As our eminent Secretary of State explains his reciprocity scheme to be, not a step in the direction of free trade, but a logical and natural outgrowth of the principles of protection, derived from experience, and carried to its fullest extent; so the warning I would give in regard to electric lighting is the natural outgrowth of the experience I have had in following the course that I have heretofore recommended, namely, to consolidate the two lighting systems under one management. All that has been said of the advantages to be derived in the lessening of salaries, office expenses, etc., by having the gas and electric works under one management, is true. It is also true that a gas company can afford to generate, distribute, and sell electric light cheaper than an electric company doing *only* that business.

But it is not true that, therefore, the gas company will make more money by undertaking the electric lighting than by not undertaking it.

To say that no money can or will be made by the gas company in electric lighting would be untrue, for, in many cases, fair profits are realized; but if the same amount of money that is necessary to equip an electric station and construct circuits were devoted to improving the gas plant and extending and enlarging mains, greater profits could and would be made in the long run.

Those of you who have recently talked with agents of the various electric lighting systems, and have carefully figured with them on the cost of installing and operating an electric light plant, making the usual large allowance for incidental expenses and repairs, will be inclined to question this statement.

Those of you who have been in charge of a station, and have collected the rents and paid the operating expenses for a year or two, will probably have a suspicion that there is some truth contained therein.

One reason why electric lighting does not pay as well as we are led to

expect is, that we are charged entirely too much for the apparatus in the first place, and the same extortion is practiced upon us throughout for material needed in operation and repairs. Enormous profits are made by the electric companies on all the electrical appliances entering into the business, and these profits are taken out of the capital invested by the local operating companies and their earnings.

Another reason is that mishaps frequently occur, through freaks of the electric current entirely beyond our control or knowledge, and from lightning strokes and short circuits, often entailing expensive repairs, if we are fortunate enough to escape damages through the courts. These are never calculated upon, because there is no reliable data on which to base calculations; still, they always happen more or less often.

Again, an electric plant pays best when the total number of lights for which it was built are in use; any less number makes the capital invested, the labor and superintendence too great for the most economical working. That is the point we strive to reach, and when accomplished we find it a very distressing position. If one or two more lights are demanded, we must either lower the candle power of all in use, erect more machinery, or refuse the demand. If we try the first plan, there is a very general kick; if the second is determined upon, we place ourselves back to a less economical working point; and if the last is resorted to, another electric company is promptly invited to partake of our "pie."

As the first hint given you will certainly not be taken, since the circumstances governing each case are different, and they determine the question of whether you will or will not engage in electric lighting, the other hints are in order.

In the first place purchase your electric machinery and appliances of the best and most reliable manufacturers. Of course, I could not tell you where and of whom, but that is professional knowledge which would require some consideration before it could be disclosed. In contracting for it the best practice is, probably, to have the electric company furnishing the plant to erect it and turn it over complete, and after a month's working test. This obviates any question arising as to where the blame attaches, should anything go wrong. Much trouble and expense will sometimes be saved if your contract states that when furnished, the entire plant shall be inspected by the expert employed by the insuranre association of your district, and that it shall be made to comply with the requirements of the board of underwriters and city authorities. The most reliable company, with every desire to erect you the most complete and thorough work, has to depend upon workmen who are not always as careful as they should be, and a thorough inspection of every part of the plant by a competent and impartial expert is abso lutely necessary. As the insurance board will demand your compliance with their rules, their expert is a suitable one to say when the plant is properly installed. Besides, the fact of his having passed upon it would have strong bearing upon the question of liability for damages caused by imperfect connections, should it be brought before the courts.

Another thing that is well to have embodied in the contract is your right to use any and all of the patented appliances purchased in connection with the plant, and that you be protected in said use from costs and damages through suits brought by others claiming such right.

In your talks on the subject with the agent of the electric company which you have selected to close your contract with, you will have become convinced that a high-speed engine with direct belting is, on the whole, the best power for you to purchase; both on account of the economy of first cost and the compactness of the plant. Also, as obviating the extra friction of the countershafting and increased liability of slipping belts, and wear and tear of the same. You may have started into the matter with conviction, based upon theory, that the cheapest power, in the long run, is the comparatively slow-speed engine with countershaft, from which can be belted one or more dynamos. You may even have studied the subject some, and read reports from American and English sources, as to the best practice. In both you will find different opinions, and while the English practice is mostly with the countershaft, they acknowledge that in the "States" many are successful with the use of direct belting on high-speed engines.

The general practice in this country has been with this class of engines, and it is in this country where electric lighting has made the greatest advances, and is more generally used. Therefore, it will be argued, the direct belting on high speed engines *must be* the best. And so many instances of this kind of plant will be quoted, that you will hardly dare to put your judgement, based on theory, against the general verdict. Especially will this be the case if you are a *modest* man, as are most gas men. Right here I will give you another important *hint*. If you have about concluded to install a high speed engine and direct belting, the advice of *Punch*, before quoted, is again applicable—"*Don't.*"

The advice of the electrical agent is all right from his standpoint. In order to induce your Board of Directors to purchase an electric plant at all, it is necessary to make the first cost as little as possible; and since the price of the electrical machinery must not be scaled, in justice to his employer, the lowest priced steam plant must be recommended. And since many others have used it with success, why not recommend it? He may tell you, and with entire truth, that it does not matter to him what system of power you use, and that if he is to supply it, he will charge you only the net amount that it costs him. That may be so, still the bias is there toward the lower cost for power, so the large cost of the electric apparatus will not make so great an impression when the total price of the plant is considered.

Now I am not up here as a target for the advocates of high-speed engines to fire at, nor am I employed to advocate the use of the other class. I am only giving *hints* derived from personal experience. I may have been unfortunate in getting the worst engines of the particular make, or in being incompetent myself to manage a high-speed engine, or have depended upon careless and incapable engine men; be that as it may, the high-speed engines that I have used, from three different and highly recommended makers, have proven quite expensive to operate and maintain; and in two stations I have substituted the slower speed engines with countershafts, and with very gratifying results. The high-speed engine giving the most satisfactory service, under my observation, is one furnishing the power to operate a street car line, where the load is constantly varying, between wide limits, and in such a case, the prompt and efficient automatic governor, regulating the speed to a nicety, is of very great value. Even here, I believe, economy of fuel and repairs would be greatly on the side of a slower engine with countershaft.

Having spoken so often of high and low-speed engines, it might be well to explain what is meant by the two terms. It is not necessary to go into an elaborate definition, but it will answer our present purpose to consider the high-speed engine to be one making say 180 revolutions per minute; and the slow-speed engine as making about half that number per minute. The piston speed in feet per second may in both cases be the same. Should that be the case, the diameter of the cylinder in engines of equal power would be the same; but the length of cylinder, and therefore of stroke in the low-speed engine would be double that of the high-speed engine, and the number of strokes, and hence of changes in direction of all the moving parts, of the latter will be twice as many as in the former. It is this frequent change of direction, as well as the additional liability to hot journals, in the more rapidly revolving main shaft and crank pin that causes much of the extra expense in operating the high-speed engine.

It may be argued that the cut-off remaining say at one-quarter of the stroke in both instances, the amount of steam used will be the same, whether in the cylinder of 18 inches in length or that of 9 inches. It certainly would seem so. However, I am convinced that more steam will be used, in practice, to develop the same power in the high-speed engine. The exact proportion I am unable to state. One reason why this is so, I presume, is because double the amount of inertia is developed in the high-speed engine, consequent upon doubling the number of changes in direction of the moving parts, and this inertia is developed at the cost of the power. The wear upon connecting rod and main shaft, journals, crank pin and brasses, and main pillar blocks is also doubled, since the knock, if one occurs, be it ever so slight, is twice as often and the corresponding jar to the entire engine is twice as frequent. More oil, and that, too, of a better quality and higher price is necessary. The stoppages of the engine and consequent interruption in the light are also much more frequent, and this is a matter which causes more gray hair on the manager and more profanity in the community than any of the other evils mentioned. If my trouble resulted from slack management and incapable help, many of my hearers are liable to be similarly unfortunate, for the Superintendent cannot always be present, and engine men are "pretty much of a muchness."

Beware of the insulation around your main wires, and for that matter, around all your wires. When I had absorbed all the information which my friend, the electric agent, could or would supply, and had read the glowing descriptions of the various insulated wire manufacturers, each one making the best, I came to the conclusion that the safest to use was "Underwriters" wire. That surely must be all right, for the name indicated that it would satisfy the insurance men, and the records showed that more of that kind was in use than of any other. Besides, it was quite cheap as compared with the "Okonite" and such. In my stupid ignorance I did not dream that the name was due to the fact that it was about the only kind of covered wire, claiming to be insulated, that the *Underwriters* objected to. It's all right *inside* of a building when thoroughly protected from rain, steam, dampness, rats, and rubbing,

and might possibly protect the wire from catching fire if exposed to a gas flame, but to confine the current of electricity, out of doors and on a rainy night, and prevent it from running to ground at every point of contact, and behaving in the most unaccountable and unseemly manner—that must not be expected of it. I hope that the time is not far distant when "Underwriters" wire will be prohibited from being used in electric lighting by the municipal authorities.

Having, through force of circumstances, entered the electric lighting field, stick to *Arc* lighting. Don't be induced to undertake the incandescent business. The expense of operating and maintaining the incandescent light is much greater and the income to be derived therefrom much less, compared to the cost of the service. Besides, you enter into competition with *yourself*, the worst form of competition. If you furnish a good 20-candle power gas you will be forced to furnish 20-candle power lamps or not give satisfaction. This will reduce your rated capacity 20 per cent., and without your being able to get a corresponding increase of rental per lamp. If you can afford to sell your gas at $1.50 per 1,000 you will have to sell your electric lamp at $1.50 per month, with discount to large customers. Even at this price you will not be able to pay large dividends upon your electric business. You can not induce customers to pay for renewals of lamps burned out, through no carelessness of theirs; neither can you limit the number of hours that they will burn your lamp, when they can have it burning with no extra cost to themselves. The time may come when you will be able to sell the electric current by meter, but it is not yet. Regarding the life of the lamps, I have had more satisfactory results from using the 52-volts lamp than either the 75-volts or 110-volts. Of course the inside wiring must be of larger copper, but the extra life of the lamps will soon recoup the difference in first cost of wiring.

I have tried incandescent lighting by means of a separate dynamo and circuits, and by means of the series lamps on the arc circuit. The two methods at different works. I consider that neither has proved to be a paying investment or business. The only possible consolation I have been able to derive from it is that in one case it helped me to destroy ruinous competition in the gas business, and in the other it has kept out competition in the electric field. In both instances the gas works alone, if safe from wreckers, would pay much better upon the investment.

What has here been said may seem too discouraging to those contemplating entering the electric lighting field. That is not my object. There are many cases where it would be desirable and advisable, and where I should undertake it myself, were I the superintendent of the gas works at those places.

This paper is written with two objects in view:

One is to point out some of the difficulties and disappointments encountered in the field of electric lighting which are not anticipated in our calculations when we are about to install a plant, but which, if more fully known, "might give us pause." In our desire to compass the entire field of artificial illumination we are apt to forget that it is often best to "make haste slowly."

The other object is to provoke discussion. While there is little positive information contained herein, no figures on which to base calculations, and no data to aid you in making the proper allowance in your estimates of expense in operating an electric plant, still there are *hints* that may set you to thinking and enquiring, and by that means may draw forth valuable statistics from those around you who are much more able to supply them.

Some papers are valuable on account of the information contained in themselves, others for the information they elicit in the criticisms they provoke. I live in hopes that this may at least attain to this second class.

Discussion.

The President—You have doubtless observed that the older members compare pretty favorably with the younger ones after all. Probably at no meeting have we had more diversity in the nature of the papers presented than at this. This is certainly a very valuable paper, and one that we shall be glad to hear discussed thoroughly.

Mr. Egner—I cordially agree with Mr. Boardman in his opinion about high and low speed engines. I have built and operated steam engines both on land and sea, and I know that what he says is true. There is no denying that the repairs to high speed engines are much greater. I do not want to say much about it, except that I believe from my own experience that Mr. Boardman is right. I would recommend to everyone to let high speed engines severely alone.

The President—Is there any high speed gentleman in the house?

Mr. Glasgow—There is another low speed gentleman. I want to echo Mr. Boardman's sentiments with regard to engines, and to call attention to this fact, which he, of course, is familiar with, but probably did not bring out very strongly in his paper—and that is that there is another cause, other than the wear and tear, for the loss in the frequent changes of motion in a high speed engine, and that is because in the better class of low speed engines there is an entirely different valve gear—the Corliss valve gear.

Mr. Egner—Although I say let high speed engines severely alone, yet there are occasions where you may have to employ them. For instance, with the Westinghouse engine there are times, occasions, and reasons when that engine would be better than another kind, and perhaps with other high speed engines there are occasions when they might be used to advantage; but wherever you can use a slow speed engine in preference to a high speed engine it is better to do it.

Mr. Hammatt—I would like to ask if anyone here has had any experience with the Evans friction system?

Mr. Boardman—That is a device for doing away with direct belting?

Mr. Hammatt—Yes.

Mr. Boardman—Friction on the circumference of the flywheel?

Mr. Hammatt—Yes.

Mr. Gimper—Mr. Boardman says don't go into electric lighting, because the expense of the machinery for electric lighting is so great. Does Mr. Boardman wish to imply that the expense of electric machinery is greater for a gas man than it is for other men?

Mr. Boardman—No.

Mr. Gimper—If others can afford to pay that price for machinery why cannot gas companies afford to pay it? I do not entirely agree with all that Mr. Boardman said with regard to this. I had some experience for more than a year with electric light plants in connection with the gas business, and am satisfied that an electric light plant in connection with gas is a good thing for the gas company; but I would not advise it for smaller gas companies. That is, I would not advise them to go into competition against another electric light plant. If they have the whole thing to themselves, then I think it is proper, even though they would not make as much upon it, to go into it, although they may simply protect their gas plant in many instances. As to the Evans friction system, I cannot say much about it now, but we will be ready within about two weeks to start such a machine. We adopted it after an investigation, and think it a very good thing. We have made inquiries and investigated it in places where it is in use, and it has been very highly spoken of. It is a system by which you take away entirely all belts. Special pulleys are provided for that purpose.

Mr. Coggshall—I would like to ask Mr. Boardman if his incandescent lighting was by the alternating current or by the direct current?

Mr. Boardman—By the alternating current.

Mr. Coggshall—Of course, if gas companies are prepared to do arc electric lighting they must be prepared to do incandescent electric lighting. I do not see any difficulty myself in fixing a price that will afford a profit in incandescent lighting as well as arc lighting. Your experience is very much like my own. At the same time, if I were situated as I was before we undertook to do electric lighting I should venture to do it. I should advocate it to my directors. So far we have not seen anything to regret in going into the electric lighting business. I know of an Evans friction pulley that had been operated for a year, and the parties using it did not like it; it had given them a great deal of trouble.

Mr. Butterworth—Mr. Boardman says, in speaking of incandescent electric lights: "Neither can you limit the number of hours that they will burn your lamp, when they can have it burning with no extra cost to themselves." I would like to ask Mr. Boardman if the electric light meter is not reliable and satisfactory, and if it does not do away with that objection.

The President—Mr. Boardman will make a note of these questions, and will answer them all at once.

Mr. Findlay—I would like to ask Mr. Boardman if he ever had any connection with gas works, and an outside company having an electric light plant in the same town?

Mr. Egner—I can answer that, with your permission.

Mr. Boardman—I would be very glad to have you do so.

Mr. Egner—I built a coal gas works, about two years ago, in a town where they had both arc and incandescent lighting. There was no other light there. Our gas made the electric light people very sick. We got $2 for every dollar that we put in, when we sold out; and the electric light people were the ones who were very glad to buy us out.

Mr. Findlay—That would be my experience, perhaps, except I might have to start out and butt against that company until they had spent all their money, before they sold out.

Mr. Boardman—Before answering the questions which have been asked me I wish to state that when this paper was written I was out of the reach of data, so that I could not put the figures in it that might

have been valuable to you. My former assistant, and now successor, is in the room, and I would like to ask him what the comparison of fuel, for instance, has been in his experience in operating high speed engines as compared with a low speed engine. I made the assertion when I was some distance from the central station, and made it from memory. I would like to ask Mr. Wilcox, of Macon, Ga., what has been his experience in high speed engines in the one case, and in the comparatively low speed Corliss engine in the other, in the mere matter of fuel; and also his general experience with regard to the use of high and low speed engines.

Mr. Wilcox—I have in my pocket a memorandum of the fuel used. It is a statement that I make up every week of the comparative difference between the high and low speed engines. I did not know that Mr. Boardman was going to call upon me. I have one Corliss engine that makes 75 revolutions, and one high speed engine that runs 250 revolutions. With those two working together the consumption of fuel is 4.27 lbs. per horse power; but using it singly I use 3.60 lbs. per horse power. Running the high speed engine by itself for street car purposes, making 285 revolutions, I use 5.13 lbs. per horse power. I keep my fuel account for the engines in such a way that I can make the comparison between the two; and we make that test regularly every week. The high speed engine requires about three times the amount of work on it than the low speed engine does. It requires extra labor to attend it. For the low speed engine we can use an average man, and supply the necessary intelligence from the office. You can use a great deal less fuel with the slow speed engine.

The President—Do you consider that the two engines are equally fair representatives of the two types—about equally new, and in equally good order?

Mr. Wilcox—Yes. I have a No. 1 Corliss engine, and one of the best high speed engines made; the other two rate about second and third.

The President—Mr. Boardman will now answer the questions which have been asked.

Mr. Boardman—Mr. Gimper asked if I had had competition from electric light companies in the same field. The entering upon electric lighting by my company at the time I was in charge was forced upon us by the fact that the Brush Electric Light Company had entered the field, and we were compelled to go into it. They took the entire street lighting of the city from me, and my directors (under my advice) thought it was better to enter into the competition on that line. The result was that we came into possession at a merely nominal price, as compared with what it cost them, of the entire plant. Therefore, I think it was a good move in my company to enter that field. We got a plant for $15,000 which cost over $33,000; and it was not worth $15,000 when we bought it (laughter). I will say in connection with that that the incandescent lighting was not entered into until we had a competitive gas plant, and then we went in for giving all the light that was required, and that we could furnish. If it had not been for the Standard Oil Company I would have sold kerosene oil to beat them. Mr. Gimper asks with regard to the Evans friction pulley, with no belt. I am not prepared to speak on that question, as I have never seen it in operation; but it strikes me that, unless an excessively large flywheel is employed, you will have to depend upon the high speed engine in that case as in the other, and upon the various devices for insuring sufficient friction to move the dynamo. Those of you who have had experience in that matter will bear me out in saying that a mere line of friction will necessitate excessive bearings to turn the dynamo without slipping, when we have so much trouble with a belt which covers over two-thirds of the surface of the driving pulley; and I am a little skeptical as to that until I see it further. Mr. Coggshall asked, and I answered, in regard to incandescent lighting by alternating currents. We use the alternating current and reduce it to 52 volts by the interposition of the apparatus used for changing the voltage. Mr. Coggshall very naively acknowledges that in selling incandescent lights in connection with gas it is impossible to fix a price so that it will afford a profit. If that is so, why do it at all?

Mr. Coggshall—I said that you could fix a price.

Mr. Boardman—I thought you said you could not. Can you obtain that price? We have found it necessary to compete with our gas, else we have got to shut down our electric light plant, and the capital we have invested in that and the machinery employed in it must lie idle. We have to compete with our gas plant. Mr. Butterworth asks if the number of hours of burning can be estimated, and if the meter is not a success. I am sorry to say that human nature is such that unless you have separate circuits, by means of which you can put it out at the station at a certain hour, you cannot depend upon your consumers. They will not take the trouble to turn it off when they can go out of the store and leave it burning with no extra cost to themselves. I am sorry to state that that is the fact. We might be in the same condition if we were consumers; but being in a position to criticise the consumers, we must take advantage of it as best we can. They criticise us in our office whenever they have a chance. I think those who have had experience in the matter will bear me out in this statement. And it is but natural. A man, be he ever so desirous to do what is right, cannot strictly attend every night to the turning off at a certain hour of all the electric lights in his establishment. He must leave it to his help, and the help who may have a ball or a picnic on hand, are in a hurry, and forget to do it. These things do occur. I have had no practical experience with the meter, but I have talked with those who have had, and I have been in towns where the electric light station was in full operation, and selling electric light, both incandescent and arc, I have seen, in hotels and in other places where the meter was installed, the lights cut out and no electricity used: whereas those places which had a contract at so much per year were in full blast. I do not think it is yet practicable to use a meter in distributing electric power. Every man is at liberty to have his own opinion about it. Mr. Findlay asked if we had ever had any opposition in electric lighting, and I think that came in Mr. Gimper's question—as to whether we had had competition of other lamps.

Mr. Lansden—I would like to ask whether or not the introduction of electricity in a city, in opposition to the gas company, is not a benefit to the gas company? Is it any detriment to the interests of the gas company for them to undertake to furnish the two kinds of light?

Mr. Hammatt—I have had the same experience that Mr. Boardman has. We had 15 consumers who contracted to turn out their lights, but 14 of them left them burning all night on that circuit. We had to cut them out at the station, or make other arrangements.

Mr. Boardman—In answer to Mr. Lansden's question I will state that in my opinion the ultimate effect of the introduction of electricity, either by a rival company or by your own, is an increase in the sale of gas. In either case it is my opinion that the party benefiting you loses money, be it the electric light company which introduces the light, or be it yourself.

On motion of Mr. Egner a vote of thanks was tendered to Mr. Boardman.

The paper list having been exhausted, attention was next directed to the

QUESTION-BOX.

The first query read was—"Is there any instance on record of a gas company obtaining damages from a corporation on account of a change in the established grade of a street, necessitating the lowering of a gas main?"

Mr. Pratt—We had a year ago such an instance in our town (Des Moines, Ia.), where, after obtaining the grades from the City Engineer, later in the season the grade was changed, necessitating a lowering of our pipes. We did so, and we called upon them to pay damages.

The President—Were the damages paid voluntarily, or collected by suit?

Mr. Pratt—After we had appeared before the Committee and explained the situation, the claim was paid without any contest.

The President—I have had a similar experience.

Mr. Bowen—I had the same experience, in Westchester, Pa., where the pipes had been laid according to grade, and the grade was afterwards changed. The cost of the change in our pipe system was paid by the authorities, without question.

Mr. Pratt—I would also like to add that at the time, in order to head off any difficulty thereafter, we succeeded in getting an ordinance passed by the City Council directing the City Engineer to give us a written statement respecting the grades, and that in case these grades were not followed, the city should remunerate us thereafter.

Question No. II.—"Is there any good reason why Gas Companies should not, as a means of encouraging and increasing the consumption of gas, do pipe fitting of houses at cost, and also furnish at cost chandeliers, gas fixtures and burners?"

Mr. Pratt—I think there are no good reasons for so doing. Gas companies that put in their own piping will have to carry a large stock of material that they have no use for, and will also have a great deal of waste. The styles in fixtures are constantly changing, and I do not think we should have anything to do with them except where it is necessary to secure a customer. If we find we shall lose a customer if we do not do it it might be a good idea to follow the plan in that particular case; but as for carrying a stock of fixtures, I do not think it will pay.

Mr. Bowen—I beg to differ with the gentleman upon that point. The Company with which I am connected have had considerable experience

in every branch of the business. In the last few weeks we have not only contracted to do all the pipe fitting and changes, and everything else connected with a very large institution in our town, but we have been compelled to do it by the competition with the electrtc light people. We find we are able to do the pipe fitting at a cheaper rate than ordinary gas fitters can do it, and can do it as well. If we can get a customer by so doing, we do it. We also furnish gas fixtures the same as we would furnish gas stoves. I think it is perfectly in line for a gas company not only to furnish gas stoves and burners, but gas fixtures as well, whenever it is necessary to extend the business.

Mr Glasgow—I think the conservative answer to that question would be: There are reasons why gas companies should not undertake this work, and there are also reasons and cases where they should undertake this work, and that these reasons will have to be balanced in each particular case.

Mr. Findlay—It is a matter of locality entirely. It depends altogether upon how you are situated. If you are fighting with some one else, then it would be better to do it; or if some one is fighting against you, you had better do it.

The President—Then you had better do it anyway?

Mr. Findlay—That is my opinion.

Mr. Littlehales—One reason why we should not do it is in this simple fact: Most towns will have at least half a dozen plumbers and gasfitters who have a personal interest in securing work for themselves—they are permanent canvassers for that class of work—and you, by leaving it to them, gain a certain amount of interest in their work; and they in return are interested to promote your work. The moment you take it in hand you will antagonize those men. I think the average gas man, if he looks after the manufacturing and distributing plant properly, will have lots to do.

Mr. Forstall—In connection with that I would like to ask how the legal status of a gas company with reference to explosions would be affected by their undertaking to do internal fitting—whether it would not make them more liable for damages for explosions on the inside of buildings.

The President—I think that might be answered affimatively by almost anyone.

Mr. Rusby—Would they be any more liable for damages than would any private person? Could the owner of a house recover damages from a plumber in case of accident arising from carelessness?

The President—His charges do not make him liable at all; but a gas company, being a corporation, would in every instance be held liable if the sufferer could possibly establish the fact that the injury occurred through the negligence of the company or its agents. Plumbers are generally not corporations.

Question No. III.—"Mr. Egner states that 400 pounds of coal are charged into an inclined retort (Coze system) in 8 seconds. If the lid is closed before any gas escapes, can he approximate the saving in gas between this style of charging and the ordinary charging by shovel?"

Mr. Egner—That would be rather guesswork; but from the volume of gas escaping from the mouth of the retort when charged by the shovel, and the very little that escapes when put in by the wagonette and inclined retort, I should say that probably 10 or 15 feet are saved at each charge. Still, that is only guesswork, as I have not metered that gas.

Question No. IV.—"Mr. Egner is asked whether he prefers inclined retorts or water gas. By special request."

Mr. Egner—That is another thing that depends on the location, the cost of material used, and the process employed. At St. Louis, for instance, if we use the process which we now have, and only have to pay for the material what it now costs us, I would say right here that we could make water gas cheaper than we could make coal gas with the apparatus that we have. We have only enough to make about 350,000 feet, and we did not find out how good it was until within the last year.

The President—The gentleman will not under any circumstances mention whose apparatus it is.

Mr. Egner—I will not, Mr. President; I am too modest to say that. (Laughter and applause.)

The President having announced that the question-box had been emptied, the following dialogue ensued:

VOTES OF THANKS.

Mr. Harbison—It has been very gratifying to me personally, as I know it has been to every other member of this Association, to see so large an attendance at this meeting. Many of us have come from a great distance; and many of us have come for the first time into this section of the country, that we have heard so much about. Many have brought with them members of their families. We have had special care taken of us while here, and from what we have already received we expect that care to continue while we yet remain. I think before we separate it should be our duty, as I know it is our pleasure, to put on our record a vote of thanks to those who have done so much for us by way of attention to our comfort. I therefore move that the thanks of this Association be voted to our hosts, the United Gas Improvement Company, of Philadelphia; to the Committee of Arrangement which you appointed to look after our affairs here in the way of providing for our business meetings and for our entertainment, in providing us with such hotel accommodations; to the local Gas Company, through its representatives and managers, for the exceedingly attentive care they have given us, and the liberal provision they have made for our comfort and welfare. These thanks are due from us as an Association as well as from us as individuals.

Mr. Boardman—I arose to do what my friend did quicker than I; but I cannot refrain from stating, as a member of the Committee of Arrangements, that the entire credit is due to the U. G. I. Company, and to its efficient staff, who so ably seconded the endeavor of the General Superintendent to add to our pleasure. I will second the motion of Mr. Harbison, with the request, with his permission, that to that vote of thanks be added the thanks of the Association to the Ladies' Reception Committee, and to those gentlemen who have so kindly seconded them in receiving the fairer guests of this Association, and welcoming them to the city of Savannah and to this meeting.

The President—All in favor of that motion will rise to their feet. It is carried unanimously. What further business?

Mr. Glasgow—I move you that the Council of this Association be requested to put in rigid execution that clause of the Constitution which forbids members owing two years' dues participating in the deliberations of the Association. (Seconded by Mr. Finalay and adopted unanimously.)

At this point President McMillin vacated the chair, which was taken by President elect Harbison.

Mr. Littlehales—Mr. Chairman: I move a hearty vote of thanks to our President for the able manner in which the business of this Association has been conducted. I do not remember of any meeting that I have ever attended where business has been put through with greater promptness, or conducted in better order. I am sure that everyone will coincide with my remarks upon that point, and that my motion will meet your hearty appreciation.

Mr. A. C. Humphreys—I second the motion.

The Chairman—It has been moved and seconded that the hearty thanks of the Association be tendered to President McMillin for the very able and efficient manner in which he has presided over our deliberations during the year. It is not necessary to add another word to what has been said by Mr. Littlehales. All in favor of the motion will manifest it by rising. I will not call for the opposite vote, for I see that every member is on his feet.

Mr. McMillin—I think you are mistaken, Mr. Chairman, for I did not get up. I feel very grateful for this vote, but shall not take any of your time by attempting to make a fitting response. I only want to say that it has never been my good fortune before to preside over a body of men that I enjoyed presiding over more than I have the American Gas Light Association. It has not been my good fortune to preside in any place where there were more efficient workers, and where they kept to the points under discussion, or where they observed all the little rules that are necessary for the expedition of business, than has been done by this Association. Much of the work that has been accomplished has been due to the very great aid that I have had from the Secretary, and from the two Vice-Presidents. You will remember that the First and Second Vice-Presidents have occupied the chair about as much as I have; and if I had been kept in the chair all the time I would have got pretty stupid before now; but through their assistance I think we have had a very good meeting. (Applause.)

The Chairman—Is there any further business to come before the Association?

Mr. Forstall—While the President has had a good deal to do with the actual meeting, yet I think that the larger part of the work on which the success of a meeting depends usually falls upon the Secretary. I, therefore, move that the thanks of the Association be tendered to our Secretary-Treasurer, Mr. Humphreys, for the large amount of work that he has done in getting ready for the meeting.

The Chairman—It is moved and seconded that the thanks of the Association be tendered to Secretary Humphreys for his very efficient work during the past year as Secretary and Treasurer of this Association.

Are you ready for the question? Those who favor the vote will rise. It is unanimously voted. Mr. Secretary, the Association tenders you a unanimous vote of thanks for your efficient services during the year.

The Secretary—Mr. Chairman, and Gentlemen of the Association: As you are very apt, in your over-appreciation of the work of the Secretary, to extend to him an annual vote of thanks, you must expect that his annual acknowledgment will be pretty much the same old story. However, I thoroughly appreciate your kind vote, and thank you very much for it. I would just like to add one more word: I have now been Secretary of this Association since 1883. During that time the duties of the office have increased very much—so much so that I do not feel justified in continuing in office longer. I have not felt justified in taking the office this year, but I was over-persuaded by your President-elect to accept the office for another year. I think, however, it is only right that I should say at this time that my connection with this office must cease at the end of the coming year. I presume that in making a statement of this kind, in declining an office which really has not been tendered to me, I am laying myself open to a charge of inconsistency, but I make the statement now so that you may have ample opportunity to find my successor.

Mr. McMillin—The remarks of the Secretary leave us in rather a bad position. We hardly know whether to applaud or not. We would like to applaud his speech, but we do not like to applaud the sentiment.

The Chairman—Permit me to say that from what your Secretary has said I think I am individually entitled to a vote of thanks; because it has only been by—if I may so state it—almost my command that he has consented to serve in the position of Secretary for another year, and for this I know that every member of this Association feels profoundly grateful. (Applause.) I have that feeling of regard for Mr. Humphreys (which I am happy to believe he has for me—undeserved as it is) that I doubt very much, and I am conceited enough to think that it is perhaps true, that for no other member of this Association would he have consented to serve another year. And when he says to you that he does not intend to permit his name to be used at the expiration of the next term, for re-election, he tells you what he really means. I emphasize it now simply that, knowing the importance of the position, the duties to be performed, and the comparatively few men there are in our midst, who, although capable, can devote the necessary time to the successful performance of the duties of that office, that the matter may be carefully canvassed in advance, so that when the time comes for you to make the selection of his successor no mistake shall be made. The interests of the Association have grown and are growing, and the position of Secretary becomes more and more important every year. I make this statement of the case to you so that your minds may be circulating around among the membership, to see who of all is best fitted to perform the duties, and who can devote the necessary time to them.

(President McMillin resumes the chair.)

Mr. Egner—Mr. President, I would now like to make a motion. The First Vice-President, having done something here as Vice-President, for which he certainly ought to have a vote of thanks—for he himself has said it—therefore I think he ought to have it. And although the other Vice-President has said nothing, we think he ought not to be neglected; hence I move a vote of thanks to the First and Second Vice-Presidents of the Association for the aid they have given us. (Seconded by Mr. Glasgow.)

The President—All in favor of that motion will rise. You have the hearty thanks, Messrs. Vice-Presidents, of the Association, for the services you have rendered during the past year.

Mr. Harbison—I thank you, Mr. President. Since I know that, so far as my associate is concerned, the thanks are deserved, I voted for the motion with great pleasure.

Mr. Boardman—My friend Harbison cannot induce me to go into any mutual admiration scheme on this business. He has had his vote of thanks; let him be thankful.

On motion of Mr. Harbison the business sessions of the Association were declared closed.

OBITUARY.—JOSEPH FLANNERY.

As has been previously stated in the JOURNAL, Mr. Joseph Flannery, formerly Chief-Engineer of the Standard Gas Company, of this city, died on the 15th November, after an illness of possibly six months duration. Deceased was born in Thurles, Ireland, on Dec. 26, 1843, but two months later the babe and his mother were in New York city, en route for Buffalo, N. Y., were his youth and early manhood were passed. His schooldays over, young Flannery was apprenticed to a plumber, in whose shop, and while acquiring the principles of his trade, deceased became interested in the art of gas works construction, the gas industry at that time giving much indication of the great future that was before it. Having determined to go into business on his own account, he left Buffalo to settle in Memphis, Tenn., where he formed a partnership, under the firm title of McDonough & Flannery, to carry on the business of plumbing and gasfitting. Mr. Flannery at this time made some wise investments in real estate, in and around Memphis, which rapidly increased in value. The severe yellow fever epidemic of 1871-2 caused him to emigrate from Memphis, and we next here from him, in connection with McDonough, as lessee of the Holly Springs (Miss.) gas works. Their success with that property induced them to take a contract for the construction of a water works at Montgomery, Ala., which task was followed by the construction of the Citizens gas works, at Indianapolis, Ind. They were also interested at this time in the Clarksville (Tenn.) gas works—as lessees—and were jointly interested in the construction of the Danville (Va.) Gas and Water Company's works.

In 1876 the firm of McDonough & Flannery was dissolved, and the subject of this sketch then came on to Philadelphia, remaining there, however, but a short time. Going into gas works construction on his own account, he completed the gas works at Akron, Elyria and Norwalk, Ohio, and Beloit, Wis, and also finished the water works plant at Duluth, Minn. He was also largely interested in the construction of the works of the Consolidated Company, at Pittsburgh, Pa., the Consumers, of Chicago, and, if we mistake not, the Consumers, of Jersey City, N. J. We next find him in Boston, directing the construction of the works of the Bay State Company, and these completed, he came on to New York (1887-8) to control the erection of the works of the Standard Company, to which he acted as Chief Engineer until August, 1890, resigning from the Company's service because of ill-health. A curious circumstance in connection with this history, it will be noted, is that all of the larger works whose construction he directed were of the opposition class, and what is all the more noteworthy in the same connection is that he always was personally held in high esteem by those engineers who held to what we might call orthodox ways. The concise history given above (in chronological order, it may be somewhat uneven, but it was extremely difficult to collate the facts) will go to show that deceased was no drone, and that locality had little influence upon him.

Apart from his career as a builder of gas works, Mr. Flannery was also extremely active in the field of invention, as the records of the Patent Office show. His researches in this portion of the gas field were mainly in the line of improvements in water gas making and apparatus, but many minor inventions in purely mechanical devices also bear testimony to the fertility and ingenuity of his mind. Personally he was possessed of a hearty bluffness of manner that always attracted the chance acquaintance, and his robust honor usually forged the chain that bound such acquaintanceship it to lasting friendship. In 1873 he was united in marriage to Margaret G. Shea, whose death occurred in 1886. From this union there are three surviving children, two sons and one daughter. We are indebted to Mr. Flannery, Jr., to Mr. W. N. Milsted and to Mr. Charles Place for many of the facts that are set forth in this obituary note.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE main enlargements and extensions recently decided upon by the proprietors of the Tyrone (Pa.) Gas and Water Company have been completed, which despatch reflects great credit upon the business capacity of the Company's Superintendent, Mr. C. H. Dieffenbaugh.

WE had the courtesy of a visit the other day from Captain A. Q. Ross, of Cincinnati, O. The Captain never looked better in his life, we are more than pleased to say.

TOWARDS the close of last month Francis Hart, of 2,432 Cedar street, Philadelphia, was arranged before Magistrate Clement to answer to the charge of tampering with the gas meter that furnished gas to the premises, and defrauding the city of payment for gas supplied. The case was brought under an ordinance passed in 1836 which imposes a minimum fine of $10 and a maximum fine of $50 for each offense of the nature charged. At the hearing, Gas Inspector Jacob Cress testified that he had visited Hart's house once in six weeks for some months past, and that he had often discovered and repaired leaks in the house pipe from the meter. Inspector Simon Nelson testified that he had been ordered by the Gas Bureau to inspect the Hart premises on several occasions. Once or twice he had to wait for some minutes before he was permitted to examine the meter, but when he did get access to it, everything appeared to be all right. Inspector George H. Bartram testified that he visited Hart's house on November 17th. The door was partly opened by Hart, who refused to permit Bartram to enter, giving as an excuse that there was a sick person in the house. He, however, was told to "come

back in ten minutes." Bartram forced his way in, visited the cellar and there found that the meter had been removed. The street and house pipes had been connected by a rubber tube, and the gas was not being measured. Bartram then turned the gas off at the street, and reported the condition of things at the Bureau. Hart interposed a general denial, but Magistrate Clement found defendant guilty and imposed upon him a fine of $25 and costs.

MR. A. W. STEVENSON, of Hamilton Chambers, Montreal, announces that he is prepared to receive offers for the purchase of the incandescent electric light system now in operation in the town of Farnham, Province of Quebec, the purchase to include the franchise from the town. He claims that the plant is new, is in excellent order and producing a good revenue. Further, that it can be extended at a comparatively small outlay, and that the demand for the light is rapidly increasing. Farnham is composed of the villages of East and West Farnham, and is located in Broome county, Quebec, the east portion lying at a point 51 miles east southeast of Montreal, and 24 miles north of Richford, Vt. West Farnham, which is much the larger portion of the town proper is a very busy place, and it might be a good business speculation were the purchaser of the Stevenson electric light property to secure a gas franchise and operate the same as a joint venture. The population of the town of Farnham is about 5,800.

THE capital stock of the Atlantic City (N. J.) Gas and Water Company has been increased from $100,000 to $300,000. The Company has enjoyed a most prosperous season.

A BOSTON correspondent informs us that the Board of Gas and Electric Light Commissioners has rendered a decision in the case of the New England Shoe and Leather Association and others against the Edison Electrie Illuminating Company, that is of great general interest and important in that it is the first one to be tried under the new statute giving a right of appeal to the Board where a company refuses to supply gas or electricity. The case involves the right of a company to agree to use only another company's lamps to the exclusion of all other kinds. It was upon this contract that the Edison Company insisted most strongly that it could not be compelled to furnish the electric current asked for. The Board finds that the Edison Company must supply the petitioners with electricity irrespecive of the sort of lamps that are in the Company's buildings.

WE are indebted to the Keene (N. H.) Gas Light Company for a copy of the following circular that was distributed in that city in the last week of November: "December 1st, 1890, the Keene Gas Light Company will make a reduction in the price of gas from $2.50 to $2 per 1,000. All bills payable monthly. It is our desire in every way to give the best results possible to our present consumers, and tips, burners, etc., we will gladly furnish free to all consumers. We have added a practical gasfitter to our staff of employees, and are prepared to do all manner of gas piping, fitting, etc., at short notice, it being our object to do this work at the least possible cost, and all pipes, fittings, etc., will be sold to customers at wholesale prices. We carry a line of globes, brackets, fixtures, etc., and being the agents of the largest manufacturers in the United States, we can supply consumers at first cost. All desiring to burn gas who are not now consumers, and all present consumers who wish to make arrangements to put in new pipes, or increase those in use, by applying at our office will be gladly furnished with estimates of cost."

THE proprietors of the Chattanooga (Tenn.) Gas Company have made an announcement that from and after January 1st, 1891, all gas used for lighting will be charged for at the rate of $1.40 per 1,000 cubic feet —a reduction of 25 cents per 1,000. Gas used for cooking, heating and power purposes is to be supplied at the rate of $1.10 per 1,000. What? the dollar mark all but gained at Chattanooga! This is progress, surely.

AMONG the Companies that report dividends declared in San Francisco for the week ended November 17th, we note the following: San Francisco gas, 30 cents per share; Stockton gas, 25 cents per share; Oakland gas, 20 cents per share.

ADVICES from Cleveland, under date of November 29th, are to the effect that the suit of the Electrical Accumulator Company, of New York, against the Brush Electric Company has been put on trial before Judge Brown, in the United States Circuit Court. The original bills of complaint (filed March 17, 1887) allege that M. Camille Faure, of Paris, France, was the first inventor of certain improvements in polarization of secondary batteries, and that he applied to the United States Government for a patent. While his application was pending at the Patent Office, Mr. Charles F. Brush, of Cleveland, Ohio, filed an application for two patents on polarization, and the Patent office, instead of declaring an "interference proceeding," issued letters patent to Faure. Upon Brush complaining of such action on the part of the authorities, they declared an "interference," and the matter was litigated for four years in the Patent Office at a great expense, the result being that Brush obtained his patents. The Electrical Accumulator Company then began two suits, asking that the Brush patents be repealed. They afterwards wished to withdraw the suits, but the Brush Company at first objected. As, however, one patent was all that was necessary, one suit was allowed to be withdrawn at the cost of plaintiff. The Brush Company then filed an answer to the other suit in which they asked that the Faure patent be declared invalid, and the question to be decided in the suit now on trial is which of the two patents—the Faure or the Brush—is the valid one.

CHARLES NEWKIRK, formerly a Collector in the employ of the Rondout and Kingston (N. Y.) Gas Light Company, is no longer in the service of the Company. He was discharged for cause.

FIRE CHIEF MANDERBACH, of Akron, O., has notified the local electric light company that its wires are dangerous to the community because of imperfect insulation.

MR. I. C. COPLEY, of the Aurora (Ills.) Gas Company, was in New York recently on a business trip. He found time, however, to "'Rah for Yale" at the great football match between the Yale and Princeton College football teams, on Thanksgiving Day.

THE Burgesses of Shippensburg, Pa., have passed an order authorizing the Shippensburg Gas Company to engage in the business of supplying electric currents. Section 4 of the ordinance provides that if at the expiration of a year from its enactment the Company shall not have begun the supply of electricity, the ordinance shall lapse; further, that if the Company shall, after it has actively engaged in the business of supplying electric light, fail to maintain the supply for a period of six months continuously, the ordinance will be void. The borough also reserves the right to place fire alarm wires on the poles to be erected by the Company.

THE Directors of the Portland (Me.) Gas Company have declared a dividend of $2.50 per share, payable on demand.

MESSRS. S. H. VANDEGRIFT, J. J. Vandegrift and J. I. Buchanan, all of Pittsburgh, Pa., have chartered the Amyville-Youghiogheny Gas Coal Company. It is capitalized in $250,000.

THE Taunton (Mass.) Copper Company will experiment with a fuel gas process in their extensive shops, at Weir.

AT the annual meeting of the Superior (Wis.) Light and Water Company, the following officers were elected: President, A. H. Wildner; Vice-President and Treasurer, V. M. Watkins; Secretary, Frank A. Ross; Directors, R. C. Eliot, Frank A. Ross, V. M. Watkins and Governor Merriam, of Minnesota—all re-elections. The affairs of the Company were discussed in an informal manner, and General Manager Mather was highly complimented for the results that followed his intelligent control.

MR. ALBERT R. WILLARD, who has been with the Springfield (Mass.) Gas Company for the past 10 years, has been appointed Superintendent of the Greenfield (Mass.) Company. Mr. Henry Kelly, whom Mr. Willard succeeds at Greenfield, goes to Waltham, Mass., there to act as Assistant Superintendent of the local Company.

THE proprietors of the Bellevue (Ky.) Gas Company have determined to make extensive additions to their works. A new holder is among the possibilities.

L. M. HALE, Superintendent of the Emlenton (Pa.) Gas Light and Fuel Company, has been authorized to announce a reduction in rates, the same to date from the first inst. This action is noteworthy, in that it is in direct opposition to the current practice in the natural gas districts, which is all in line with the policy of increasing instead of lowering the charges for a supply of gas. The new Emlenton schedule (it virtually means a reduction of 20 per cent.) is as follows:

Cooking stoves	$2.22 per month.
First heater	2.22 "
Second "	1.67 "
Third "	1.11 "

Prompt payment secures a further rebate of 10 per cent.

CHRISTOPHER BEHAN recently appeared before the Contracting Board of Troy, N. Y., and testified that work on the Hill street sewer was delayed because the mains of the Troy Gas Company were laid in the lines of the proposed sewer, and that the Company declined to remove them. On motion of Corporation Counsel Roche, the Secretary of the Board was instructed to notify the Gas Company that the mains must be removed within 36 hours from the issuance of the notification, failing which the removal would be made by the City Engineer.

THE waste material resulting from the use of quartz sand in the grinding of plate glass, is, according to the *Brickmaker*, being utilized in the manufacture of a new brick. The refuse sand, which contains about 15 per cent. of glass particles, and 2 per cent. of iron particles, is very hygroscopic, and before it can be used for the manufacture of bricks has to be dried, after which it is pressed into the mold under a pressure of 660 pounds per 0.155 square inch. The pieces thus obtained are subjected to a heat of 2,732° F., and at this high temperature the glass enters into combination with the sand, a new product with new properties being thereby obtained. The bricks thus produced have a specific gravity of only 1.5. They are perfectly white, and as they are not attacked by acids, they would be especially desirable for use in manufactories of chemical acids, perhaps particularly so in plants devoted to the production of sulphuric acid. They are also unaffected by frost. Respecting the strength of the material, experiments are said to have shown them to possess a compressive strength of from 840 to 975 pounds per 0.15 square inch. By mixing the sand, enameled bricks, showing beautiful colors, are obtained, which may be used for decorating fronts and interiors.

THE awards made last month for the public lighting of Jersey City, N. J., for one year, were as follows:

Contractor.	Section of City.	No. Lamps.	Rate per Lamp per Year.
U. G. I. Company....	City proper.....	935	$20.00
" "	Greenville section....	150	21.00
Globe Gas Light Co...	Suburbs....	1,500	20.16
U. G. I. Company....	Bergen & Hudson Cty	1,411	21.00

Hudson County Electric Light Company—any number of arcs, 23½ cts. per night.

The Jersey City Electric Light Company supplied the arc lamps last year, and were paid therefor at the rate of 29½ cents per light per night. As these lamps are burned an average of 10 hours per night, and are supposed to yield 1,200-candle power, we fail to see where any profit is to accrue to the last successful contractor on the basis of the bid of 23½ cents. However, a good deal depends on the "load" that the dynamos may be asked to carry.

MR. G. FRANK CLINGAN, of the Frederick (Md.) American Light and Heat Company, follows the plan of advertising in the local newspapers the time at which the discount period for prompt pay expires. For instance, at Frederick the discount period ceases on the 10th day of the month, and an advertisement to that effect appears in the newspapers from the 1st to the 9th.

THE proprietors of the Plainfield (N. J.) Gas Light Company have practically secured control of the Plainfield Electric Light Company, and both interests will hereafter work in harmony.

THE Citizens Gas Light and Heating Company, of Coudersport, Potter county, Pa., has been incorporated. It is capitalized in $60,000.

ON the evening of November 29th, Jonas Chapman, engineer for the Owosso (Mich.) Gas Company, started from the main works, lantern in hand, to inspect the oil tanks, in which a carload of naphtha had been stored in the afternoon. A startling explosion that followed Chapman's disappearance, brought the work hands to the tanks, which were found to be completely wrecked. The damage amounts to $5,000. Engineer Chapman was killed.

A CORRESPONDENT at Oshkosh, Wis., writing under date of Nov. 29, says that the suit against the city by the Oshkosh Gas Light Company is being dragged out at great length in the Circuit Court, and the question at issue—which is in respect to the legality of certain public lighting awards—seems to have resolved itself into a sifting of the merits of the Brush system. The charge of the plaintiff that the contract was not let to the lowest bidder is met by the defendant with the reply that it was let to the lowest responsible bidder, inasmuch as the Thomson-Houston system was so superior to the other, that the difference more than made up for the higher rate—a novel way of putting it, to say the least. The Gas Company naturally takes the position that the Brush light is fully as good as the Thomson-Houston, and fortifies that assertion by some strong testimony from acknowledged experts on such matters. The plaintiff also presented testimony going to show that the Aldermen freely stated, before the award was made, that the lowest bidder would secure the contract, but that such was not the final outcome. The Gas Company thus far, our correspondent intimates, has much the better of the argument.

MESSRS. J. PAINTER & SONS, at their South Side mills, Pittsburgh, Pa., are experimenting with Lima oil, in the hope and belief that it can be successfully employed to supersede gas fuel in their puddling furnaces.

THE Meter-Register Company, "to manufacture meters and meter appliances," has been incorporated at Chicago by Messrs. D. E. Felt, G. W. Martin, and C. J. De Berard. It is capitalized in $500,000.

AT a special meeting of the Milwaukee Common Council it was virtually agreed that the local Badger and Edison Electric Lighting Companies be authorized to consolidate their interests.

A 135-horse power Armington-Sims high-speed engine has been installed in the South Center street electric light station of the Schenectady (N. Y.) Gas Company. It replaces a 75-horse power engine.

THE Olympia (Wash.) Gas and Electric Light Company has added two new dynamos to its electric equipment. One is an incandescent machine, rated to maintain 1,300 lamps (16-candle power), and the other machine is to supply current to 50 high-power arcs.

THE Midland Terminal and Improvement Company, the offices of which are to be located in New Haven, Conn., has been incorporated, by Messrs. W. M. Barse, C. F. Phillips, O. L. Snyder, James Lawton, and Frank H. Kelley. It is capitalized in $25,000. According to Article 2 of the articles of association, "The purposes for which it is incorporated are to build and construct railroads, water works, gas works, pipe lines, electric light plants, street railroads and electric railroads," etc.

THE authorities of Waukegan, Ills., have contracted with the local electric light company for 65 arc lamps (2,000-candle power), to be paid for at the rate of $65 each, per annum; a moon table to be followed.

THE Parkersburg (W. Va.) Gas Company is extending its main system.

THE new water gas plant at the Middleboro (Mass.) works is now in operation.

HANNIBAL, Mo., proposes (if the voters at a special election sanction the scheme) to issue $20,000 of bonds, to be invested in a municipal electric lighting plant.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Superintendent Newell's Concise Explanation.

OFFICE OF THE GAS LIGHT CO. OF THE CITY OF NEW BRUNSWICK,
NEW BRUNSWICK, N. J., Dec. 3, 1890.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I write to correct impressions that may be conveyed by a paragraph in your issue of the first inst., page 777, entitled, "Mayor Van Cleef, of New Brunswick, N. J.," etc., and to say that our honored Mayor has not made any complaint to our City Council on the subject alluded to; nor has he made any suggestion of "reform" to the local Gas Company; nor has the City Council taken any action in the matter.

Your information was no doubt obtained from a wild bread and-butter article which, I am told, appeared in one of the New York dailies, and which gave to the circumstance more importance than it merited.

The facts in the case are that, while attempting to discharge a tank car of naphtha by a "pipe line" leading to our works, we found, on loosening the cap on the bottom of the tank, in order to make a connection by a flexible tube to the pipe line, that the inside valve was out of order, and before the cap could be replaced several barrels of naphtha were lost. Beyond that, no damage was done to anyone.

For about 8 years all our receipts of naphtha—of a low grade and not gasoline—has been discharged as this car was undertaken to be, and no mishap has ever before occurred; very many having been discharged without the loss of a pint, and at no time beyond the loss of a few gallons. No such occurrence can be repeated, because the first thing to be done will be to examine and know that the valve is in position and in good working order.

After the discharge from this car the valve was found to be loose at one end, and as the car had just come from the repair shops, it will be seen that whatever fault there was lay with the shop at which the car was repaired, and not with the Gas Light Company nor with its system of discharging.

Having due regard for both the nerves and interests of our neighbors, *we have extended* our pipe line to a point where if any such leakage should occur in futue, to whatever extent, it would be carried in the direction of entire safety.

Our Company has never hesitated at any trouble or expense to insure safety. Our pipe line has always been kept in perfect order, and our system of discharging has been examined and approved by the best gas engineers who have seen it.

Yours very truly, JOHN W. NEWELL, Supt.

THE AMERICAN
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MONDAY, DECEMBER 8, 1890.

The Market for Gas Securities.

The market was very uneven during the week, and the bears had things pretty much their own way towards the close. To day (Friday) Consolidated opened at 91¾ to 92, which, of course, is ex-dividend of 2½ per cent., that was declared last week, and which is payable on and after next Monday. By an inexcusable oversight the announcement of the dividend was not made in our last issue. We had more than fair evidence in the fall that the rate would be increased to 6 per cent. per annum, but the conservatives finally carried the day. The earnings, however, were in excess of the 6 per cent. schedule. Other city shares show no change. Chicago gas is weak and lower, the opening price to day be- 34¼–5. Bay State gas is somewhat stronger, at 52 bid, and there can be no doubt about it that it is a purchase at anything under 60. Laclede is a trifle better, and Baltimore Consolidated is about as before. Brooklyn shares are firmly held. The powers in control in Brooklyn do not seem much disturbed at the opposition rumors, but these will have taken on something like actuality before the frost leaves the ground next spring. Any capitalist who would like to secure a pretty good thing in the shape of a gas and electric lighting plant in a town that is rapidly growing, might do well to communicate with the proprietors of the JOURNAL.

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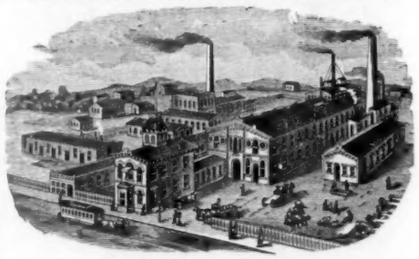

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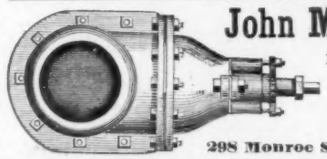

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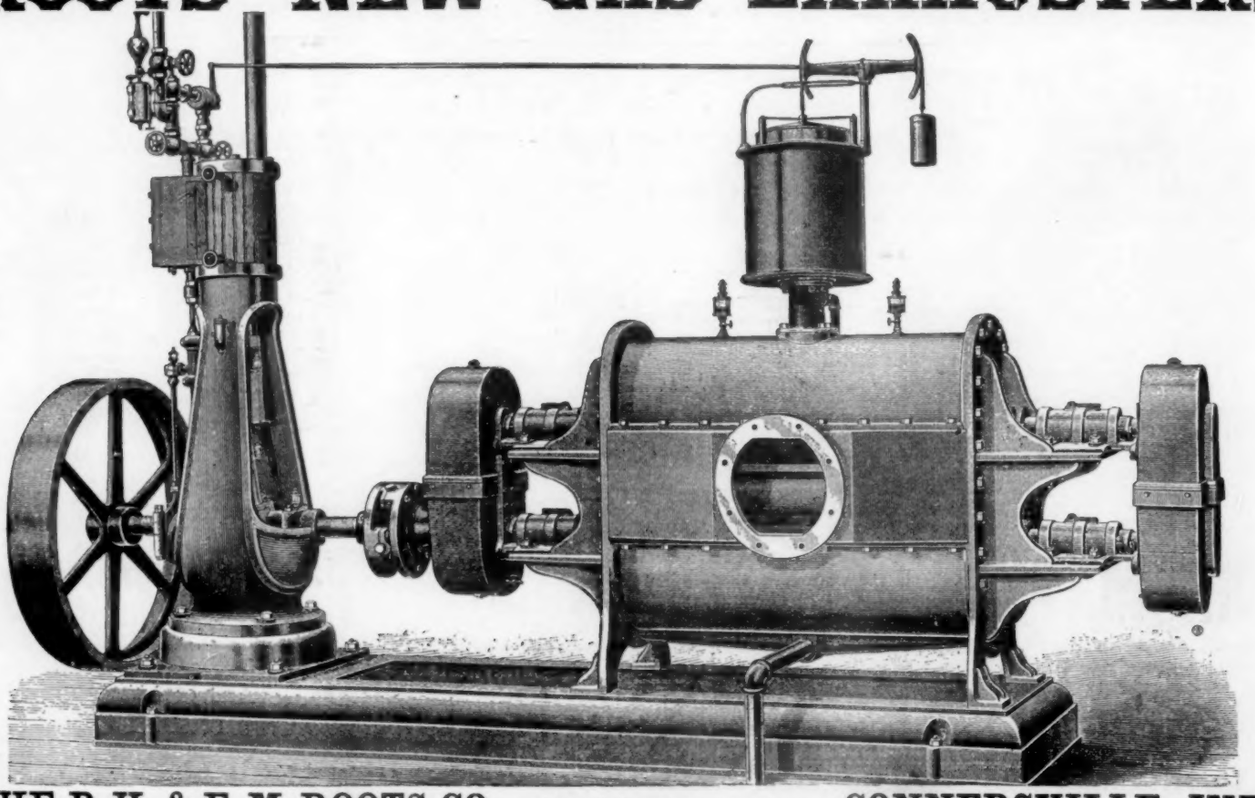

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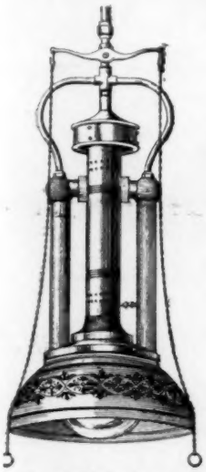

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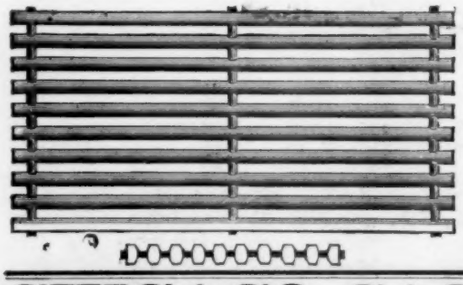

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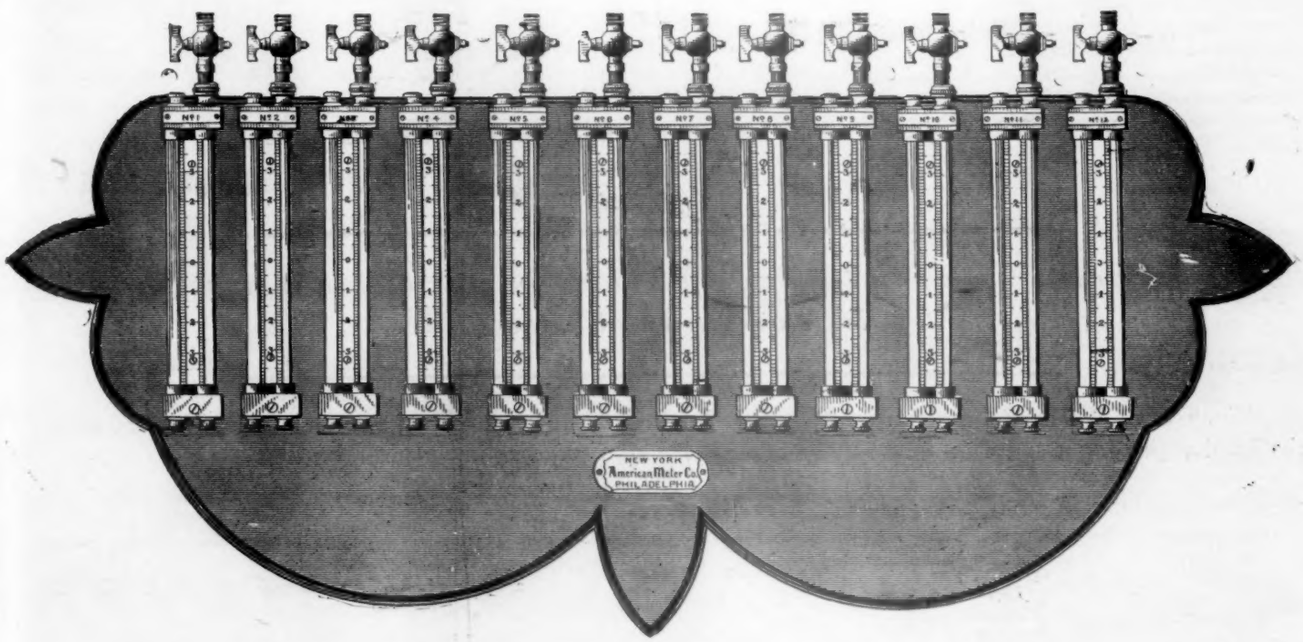

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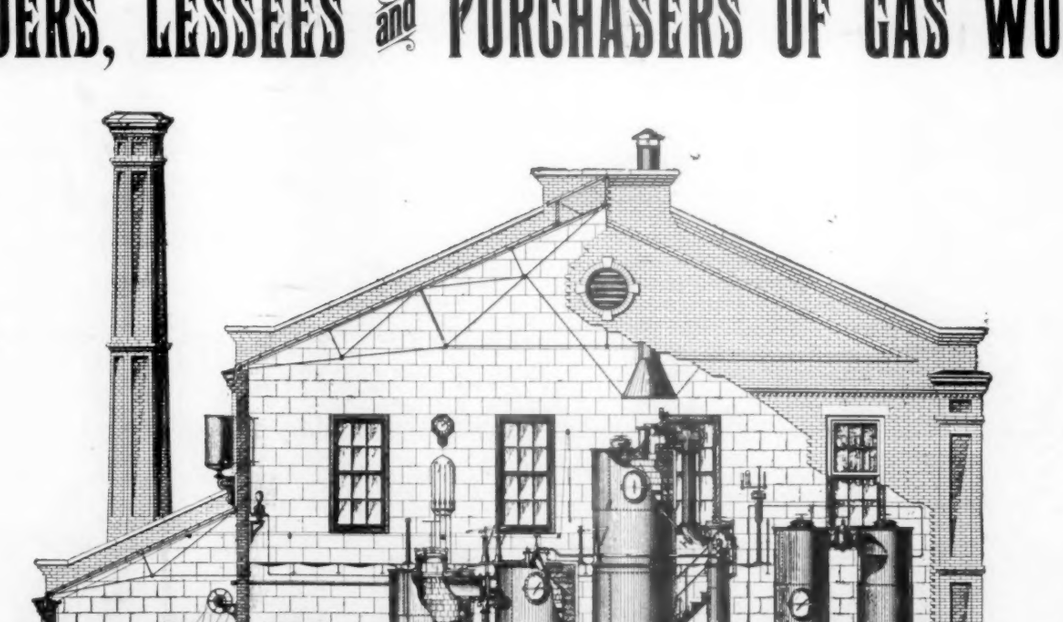

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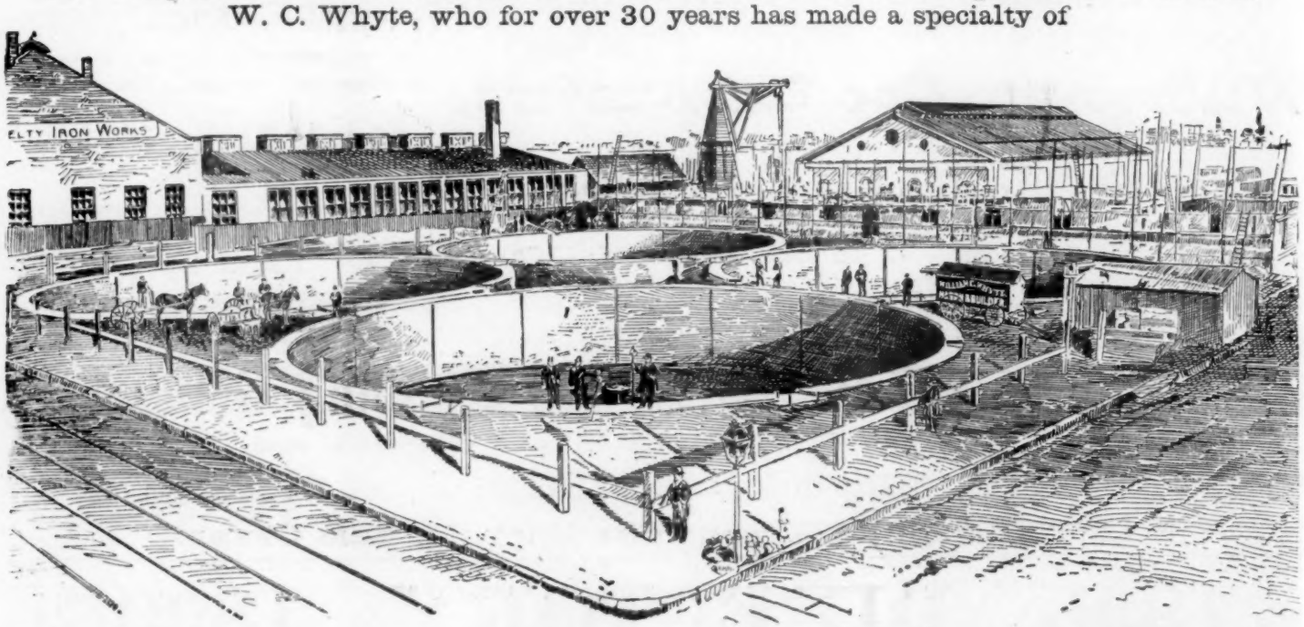

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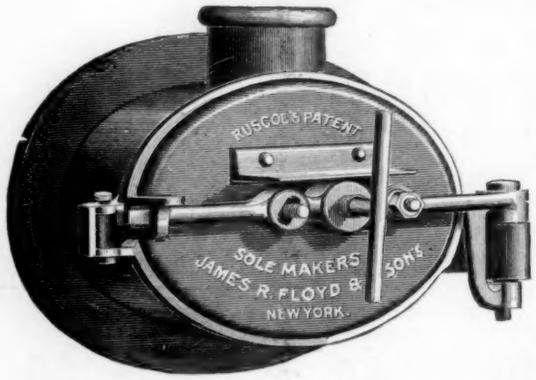

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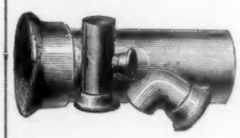

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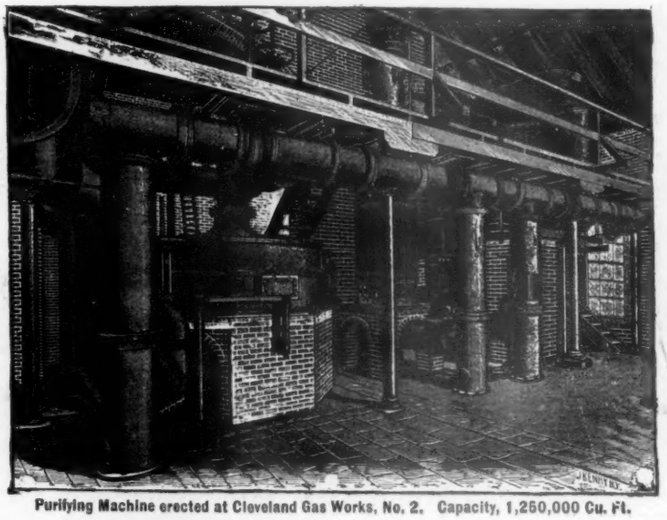

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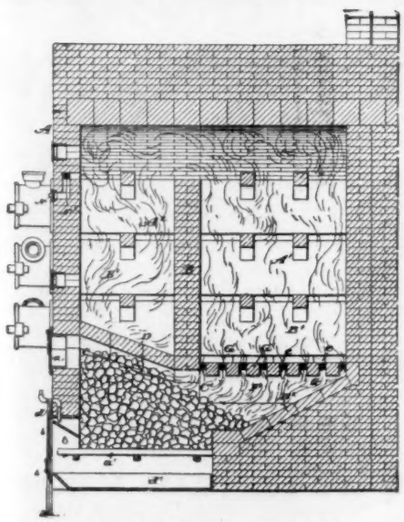

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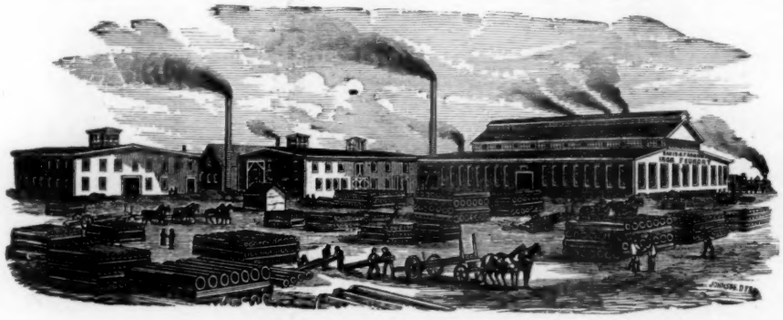

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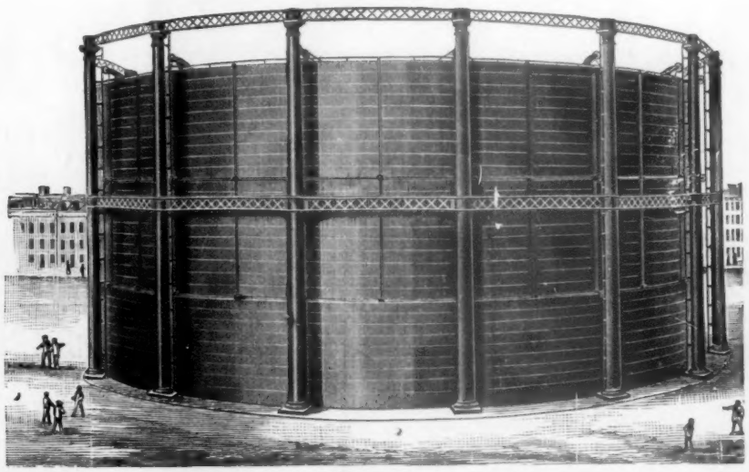

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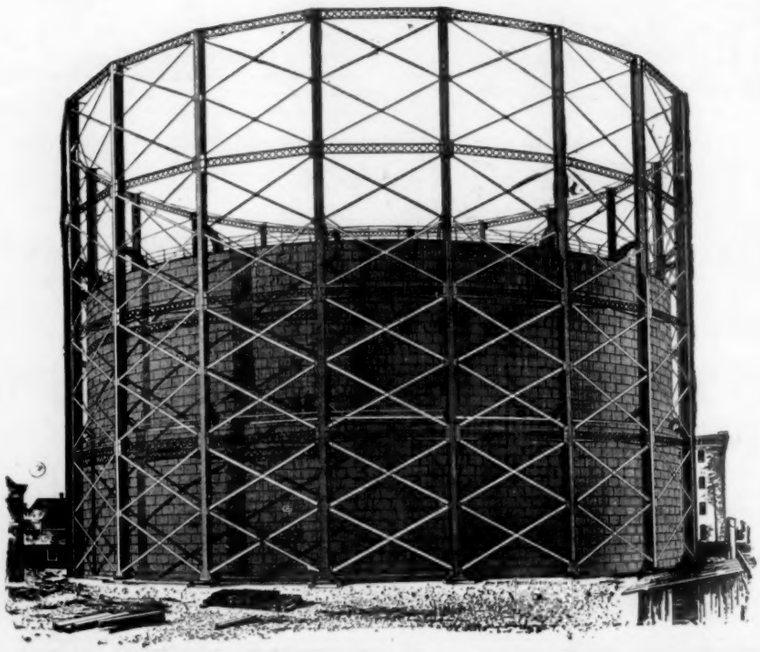

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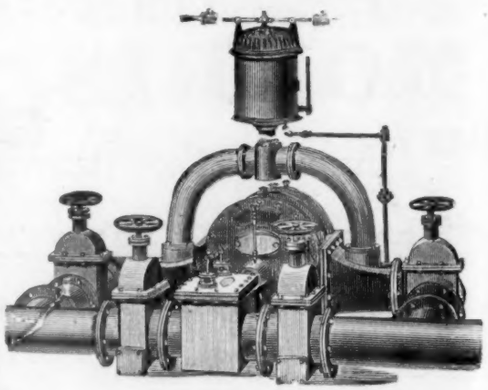

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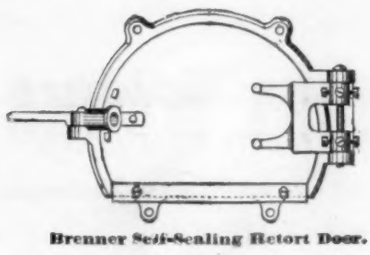

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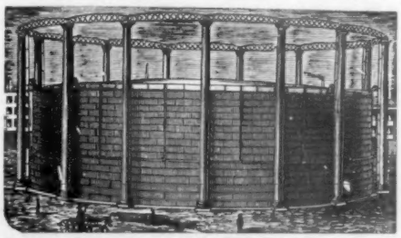

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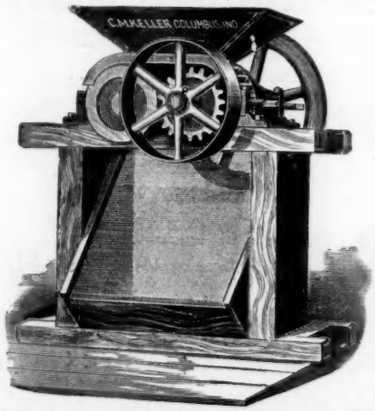

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"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

½ in. supply pipe should be used where the pressure is 1 in. or over.